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SCIENCE EDUCATION

VOLUME 34 OCTOBER, 1950 NUMBER 4

SCIENCE EDUCATION

***Formerly* GENERAL SCIENCE QUARTERLY**

SERVING TEACHERS IN ELEMENTARY SCHOOLS, JUNIOR AND SENIOR HIGH SCHOOLS, COLLEGES, AND PROFESSIONAL SCHOOLS FOR TEACHERS

VOLUME 34 | OCTOBER, 1950 | Number 4

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INTRODUCING THE CONTRIBUTORS

Dr. H. Clark Hubler is Professor of Science Education at Wheelock College, Boston, Massachusetts. His major interest is concerned primarily with science for elementary schools. He formerly taught at the Teachers College of Connecticut, New Britain, Connecticut. He also served as science consultant at Horace Mann—Lincoln School of Teachers College, Columbia University.

Dr. Julian Greenlee is Professor of Elementary Science at Western Michigan College of Education, Kalamazoo, Michigan. He is Vice-President of the National Council on Elementary Science and is currently acting as President during the absence of Dr. H. Emmett Brown who is in Burma.

Mr. William C. Curtis is a teacher of chemistry in Dunbar High School, Washington, D. C. He has B.S. and M.S. degrees from Howard University and is working on a Ph.D. degree at Georgetown University. His numerous publications have appeared in *School Science and Mathematics, The Chemistry Leaflet, Journal of Chemical Education*, and *Beta Kappa Chi Bulletin.*

Mr. Jerome Leavitt is instructor in Elementary Education and Supervisor of Student Teaching, School of Education, Northwestern University, Evanston, Illinois. A native of New Jersey, he has a B.S. degree from New Jersey State Teachers, Newark, New Jersey and an M.A. degree from New York University. He also attended Teachers College, Columbia University. His teaching experience includes: industrial arts and science in the Roslyn, New York, elementary schools; engineering in Sperry Gyroscope Company, Brooklyn, New York; principal of the elementary school at Los Alamos, New Mexico. His publications include more than twenty papers in numerous publications.

Mr. J. C. Ferguson has been a representative of Ginn and Company since 1921 and is now in charge of the Chicago area. A native of Wisconsin, his teaching experience included rural and high school teaching, service as principal and superintendent of schools at Ontario, La Forge, and Fennimore, Wisconsin; Principal of the Country Normal at Fennimore, Wisconsin. Mr. Ferguson has had a life-long interest in promoting better teaching of science and mathematics in the elementary schools and in the pre-service and in-service training of teachers.

Mrs. Dorothy C. Waite, a native of Pennsylvania, has B.S. and M.S. degrees from The Penn State College. Mrs. Waite has had many years teaching experience and is presently teaching sixth grade in the State College Public Schools, Centre County, Pennsylvania. She was a member of the summer school faculty of The Pennsylvania State College in 1949 and 1950.

Mr. Wayne G. Christian, a native of Missouri, has a B.S. degree from West Texas State College, Canyon, Texas and an M.S. degree from the University of Denver, Denver, Colorado. He also attended Panhandle A. & M., Goodwell, Oklahoma; Maryville State Teachers College, Maryville, Missouri; and Colorado State College of Education, Greeley, Colorado. He is now instructor in the School of Education of the University of Denver.

Mr. Stanley B. Brown, a native of Michigan, is now a graduate student in Science Education at Stanford University, California. He is on leave from the Science Department, El Camino College, California. Other teaching experience includes, Hayward Union High School and David Starr Jordan Junior High School, California. Degrees include: A.B. Louisiana State University; M.A. Stanford University. He served as an Aviation Technical Training and Administrative Officer, United States Naval Reserve, for four years during World War II.

Drs. George W. Haupt and George Greisen Mallenson are well-known by readers of *Science Education.* (See *Introducing the Contributors* column of October, 1948, *Science Education.*)

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SCIENCE EXPERIENCES FOR TEACHERS OF ELEMENTARY SCHOOL CHILDREN *

JULIAN GREENLEE
Western Michigan College of Education, Kalamazoo, Michigan

I BELIEVE that in general we can say our problem is no longer one of selling educators in our elementary school systems on the significance of science as a part of the educational program of children. One has only to attend a meeting of an organization such as the National Council for Elementary Science to see that these people are looking for ideas as to how best to proceed with the problem of carrying on a program of elementary science instruction. Classroom teachers are concerned with how to do it and administrators are concerned with how they can help their teachers. This is highly encouraging.

I believe that, at the present time, we can also say that we know of professors in Teachers Colleges in many sections of the country who are carrying on desirable programs of education in science for elementary teachers. This also is highly encouraging. However, we know of many situations in which elementary teachers are being prepared by an outmoded high school method. We know of situations in which instructors who have much information in terms of a few science areas but little in terms of larger patterns and in terms of children's needs, are teaching science to children in elementary schools. This is discouraging. However, such situations are to be expected due to the fact that an awareness of the need for science is more general than are ideas as to desirable procedures. A partial answer of course is in terms of more science training for the elementary teachers; but "what" science training is more important than "how much."

It is encouraging to know that we can go into some classrooms in many different parts of the country and see teaching which is providing students with desirable science experiences. The following examples in different classrooms were witnessed recently: A group of intermediate children were trying unsuccessfully for the moment to float a needle on the water in a bowl. The teacher helped them by demonstrating one way of doing it. On seeing the needle float, one child said "would a magnet pull the needle now?" When the teacher said, "If we had a magnet we could see" one of the children produced a small but strong magnet from his pocket and held one end next to the bowl adjacent to one end of the needle. The needle was pushed back. One of the children said "It looked like it moved back." Another said, "Change ends with the magnet." On changing ends the needle was pulled toward the magnet but again was pushed away when the magnet was reversed. One of the children asked, "Is the needle magnetized?" Another said, "I think it has to be." Several of them then looked to the boy who had brought the needle. He said, "I magnetized a needle last summer and this must be the same one."

In a fourth grade classroom, a child in answering something about which he was not sure said, "I may be wrong but I think" as he was hypothesizing, but when he made a statement about something else

* Paper presented at the Atlantic City meeting of the National Association for Research in Science Teaching, February 28, 1950.

on which he had definite information his remarks were straightforward.

A college student raised a question, "How is it possible for an ice sail boat being pushed by the wind to gain a higher velocity than the wind?" The teacher said, "I have some ideas but they are pretty far back in my mind, perhaps some of you have ideas on this and they may be up in the front of your mind." One student said, "I don't understand it but maybe this thought will give someone else an idea. It is possible to have an arrangement so that something moving slowly makes something else move faster, for example, a worm-gear drive." Another said, "I have never ridden an ice sail boat but perhaps it is a matter of momentum and the boat is given a high velocity by gusts of wind. Is there someone here who has ridden one?" A hand went up and the student asked, "Does the ice sail boat travel faster than the greatest velocity of the wind?" The answer was in the affirmative. He then said, "Well, my idea about momentum doesn't help then." Another student said, "The sail is always at an angle and the suggestion about a moving object giving a greater velocity to something else gives me an idea. I'll try to explain it by using a diagram on the board." His explanation was satisfactory for the purpose.

I believe we would all agree that the learners referred to in the three preceding situations are developing desirable characteristics. These attitudes didn't come naturally and neither did they come as a result of verbalizations about such things. They did, however, come as a result of appropriate classroom experiences. Perhaps the students were not particularly conscious of possessing them but no doubt the teacher in each case had them in mind in providing experiences in the past.

We as scientists in solving a problem follow a scientific procedure including very careful checking of our final results before we assume that our conclusions are correct.

If I, as a chemist, am developing a plan for a new synthesis of a compound, I will take into consideration all available information before assuming that I am ready to proceed with the trial synthesis. I will then check my process and products at each step along the way. Finally, I will carefully analyze the material I get before deciding that my plan of procedure was correct. Aren't we then, as science teachers in a teachers college, being inconsistent when we assume that we can evaluate the results of our work in educating teachers by mere subject matter examinations during the process? Doesn't this correspond to doing some sampling during the early stages of a trial synthesis? Isn't the only effective measure of our results the success of the classroom teachers in working with children after graduation from our colleges? It then seems only reasonable that each of us should assume the responsibility of visiting the children being taught by some of the graduates from each of our classes.

If I were a manufacturer of furniture, I would plan to inspect some of my product after it had been subjected to normal use for several years. I would ask the user for suggestions as to ways in which I might improve my workmanship. Doesn't the product of our teachers colleges merit similar consideration?

We think of scientific truths as being the best interpretations of the best information that we have. Certainly, in the educational programs for our teachers, we should apply our best information. Much is known about the ways in which people learn and the types of experiences that are responsible for developing specific attitudes. Do we use our best information? Do we, as science teachers, look to authority in the field of child development and the learning process for verification of our ideas as to what constitutes desirable experiences for children? Do we look to that source for verification of our ideas as to how best to teach science to teachers so that they may provide desirable experiences for children or do we feel satisfied when we have mere

scientific information? As science teachers, we feel obliged to have our students develop habits of checking with authorities before coming to definite conclusions about science problems. Aren't we being inconsistent then if we don't check with authorities in the learning process for verification of our teaching procedures?

Try to imagine a situation in which a home is to be built and the carpenters, plumbers, electricians, heating plant engineers, brick masons, cabinet makers, landscape artists, etc., each went independently about the job of building his own particular part of the structure. Each one may be quite proficient in his field and have definite ideas as to just how to build his part so as to get the most desirable results. Then, let's confront ourselves with the task of assembling the home from these units, each of which was built without reference to the other. Of course, each of us immediately says such a plan of procedure is too absurd to deserve consideration. But, aren't we, in our programs of teacher education, guilty to some extent of doing an analogous thing? Don't we, in some institutions, have situations in which each department without too much concern for what goes on in the others proceeds on its way of providing experiences for the prospective teacher? We expect beginning teachers to integrate a satisfactory pattern of procedure from these, in some cases, unrelated departmental offerings.

Try to imagine another situation in which each builds for the particular home but in this case all of the parts are planned and constructed without reference to the community setting in which the house is to stand.

Don't we have some people on the staffs of most teachers colleges who never assume the responsibility for looking in on situations such as will be faced by teachers who are being educated by them? Is an educator who never puts himself in a position to see conditions that prevail in the public school systems justified in assuming that he can effectively help prospective teachers prepare to meet those conditions? Isn't this situation analogous to the preceding one?

If we are vitally concerned with improving our programs of teacher education, isn't it logical to proceed somewhat as follows:

1. Decide what attitudes and information we want our children to have.
2. Find the types of experiences from which they are most likely to develop these characteristics.
3. Find what must be the characteristics in terms of attitudes and information of the classroom teachers who will provide children with these experiences.
4. Ascertain what experiences we will need to provide so that the teachers will have these characteristics.
5. Then plan our program so as to give the prospective teacher the indicated experience.

Some of the characteristics that we want children to have are: (1) an understanding of the part that they may play in controlling their environment; (2) an ability to function as effective members of a democratic society; (3) an awareness of their power to provide, through science, for better living; (4) an appreciation for community, national and world resources and the part that their wise utilization plays in determining the levels of our standard of living; (5) a habit of suspending definite judgment until they have the available pertinent information about questions; (6) an attitude that truth is relative and not static; (7) a feeling that science is neither good nor bad but that the value is determined by the use to which scientific information is put; (8) an attitude of looking to understandings rather than one of accepting on blind faith things or ideas just because they have a name which may imply scientific connotations.

We can get much information from many different sources as to the kinds of experiences from which children are most likely to develop the desired characteristics. As previously pointed out, there are classroom teachers who are providing children with settings in which this is being done. It seems that the teachers who get the best results with children are the ones who themselves possess similar

desired characteristics. We can get much help by studying the procedure used by these teachers.

Of course our immediate concern is for the types of experiences that we should provide for teachers. I believe that they should be provided in such a manner that the teacher may have an opportunity to develop the same traits that we desire for children. We are all aware of that occasional teacher who, in so far as we know, participated in no program of experiences that was planned for the purpose of giving her these characteristics but yet who provides children with settings from which they develop them. We sometimes refer to him as a "natural teacher" or "born teacher." When we think about this situation, we realize that here, too, is a person who is what he is due to environmental conditions.

Obviously, any classroom teacher needs a tremendous store of scientific information. We can never provide him with opportunities to get all the information he will need. However, the mere possession of such information is no indication that the teacher will be able to teach children effectively.

The way in which the teacher is taught is equally as important as what he is taught. We are not being fair to the prospective teacher when we provide him with no opportunities to participate in learning situations in which he has a possibility of attaining the same attitudes that we expect him to want in the children. Traditional science subject-matter organization does not contribute sufficiently to these goals. For example, if we expect that the teacher will use a problem-solving approach in his teaching we must provide situations in which he will learn in the same manner.

None of us would question the statement that an understanding of science on the part of the individual improves his opportunity for complete living. Understandings develop only as a result of meaningful experiences. The individual, whether he be child or adult, should have the opportunity to become acquainted with the implications of science by attacking problems which are a vital concern to him. We have only to read the minutes of a meeting of a city council, board of supervisors, school board or any other of numerous organizations in which decisions affecting all of us are made, to see that people, many of whom have only an elementary school education, are considering problems which have definite implications for science. Whether the problem under consideration be one of planning for a new school building, enlarging the water supply system, installing a sewage disposal plant or planning a program of flood control, the individuals needs to be aware of the science involved from many angles. They will have such an awareness if they have, as children, had experience in solving problems that they recognized as being significant to them at that time.

When we say that the individual must be permitted to develop in accordance with his potentialities, needs, and interests some interpret this to mean make the learner entirely responsible for what comes into his environment. Perhaps a wiser interpretation, knowing that interests are results of experiences and thus determined by the environment, is to provide him with ever-enlarging opportunities. He needs to be aware of what choices there are as well as with consequences which follow different choices. Only the teacher who has such an awareness can help children to get it.

If elementary classroom teachers are to share planning of classroom activities with the children then they must have opportunities to see that desirable results are gotten from such procedures. Perhaps the most effective way in which they can see this effectively is by themselves sharing in similar experiences. Science teaching, whether it be with adults or little children, provides much excellent opportunity for group planning. Those teachers who do respect their students as sources of information and ideas find that they them-

selves gain much from sharing planning experiences.

We, as college science teachers, need to be aware of the fact that values to a group of students come from encouraging those who may not have as much information about the subject as we, but who do have understandings appropriate to the level of the group and can make valuable contributions. We must give our students, whether they be children or adults, opportunities to make discoveries on their own maturity levels. It is important to them. Also, many of the discoveries that are of significance to our society have been made by people who, in so far as we know, had comparatively little information about the subject. They did, however, make it a practice to follow up, in some appropriate way, ideas which they got. Some of these discoveries might never have been made by the particular individual if he had known how many times others had tried the same thing and failed. The writer knows a chemist who succeeded in developing a satisfactory synthesis for a rather important compound by using a procedure similar to one which had been tried unsuccessfully by chemists with much more training. If he had known of their failures he would never have tried the procedure.

We, as science instructors of elementary classroom teachers, need to have and manifest an interest in, and some understanding of, children. We should recognize the elementary classroom teacher as an expert in her own right. Perhaps a desirable plan would be for such college instructors to teach occasionally a classroom group of children for a semester. That particular group of children might suffer to some extent as a result of the experience. However, the teaching in our own college classes would no doubt be considerably changed. Thus, the teaching of future graduates would be improved because of our better understanding of their problems and because of the respect which we then would have for their positions.

If such a plan is impossible, then the next best thing is for the instructor to visit elementary classroom groups with sufficient frequency that he will be conscious of the types of situations constantly faced by their teacher. The subject-matter expert is very quickly and effectively deflated when he makes his first attempt at teaching science to a group of little children. It is a very effective manner of finding out that there are situations in which the teacher should not attempt to answer outright all of the questions that are raised. He also will have something of an understanding of the dilemma in which the beginning teacher finds himself when he goes out with the idea that he has at his command all of the information that he needs. We, as science teachers, know very well that we individually have understandings of only a very small part of the total information in our particular specialized field. Are we not unfair both to ourselves and our students if we keep them under such rigid controls that they never have an opportunity to see us confronted with questions to which we do not know the answer.

We, as teachers of either children or adults, do them an injustice if we lead them to believe that the total quantity of significant information in any area is so small that we understand it all.

I feel that we, as teachers of teachers, must plan and carry on activities in our classrooms in terms of problems that they will face. We must evaluate the effectiveness of our teaching of undergraduate students by their future success in providing classroom conditions in which children undergo desirable growth. We should make it our business to visit children being taught by our graduates as a means of getting ideas that will help in our teaching.

We should evaluate the effectiveness of our work in in-service education by the extent to which it brings desirable changes in classroom activities of teachers who study with us.

TEACHING MATERIALS FOR ELEMENTARY-SCHOOL SCIENCE *

CLARK HUBLER
Wheelock College, Boston, Massachusetts

THOUGH the materials of instruction are not the science program, they are an integral part of the program upon which the effectiveness of instruction may hinge.

That teachers consider the problem of supplies and equipment an obstacle has been indicated by previous studies. In 1948 Lammers [1] interviewed 100 representative teachers in Massachusetts and found a lack of time the most frequently mentioned obstacle, with lack of equipment second. In 1944 Quaintance [2] reported a survey of the problems confronted by teachers in Oregon, in which a lack of equipment was the problem most frequently reported.

In the summer and fall of 1946, the present writer conducted an unpublished survey of certain graduate childhood-education classes at Teachers College, Columbia University, in which 103 in-service elementary-school teachers reported the difficulties they faced and felt must be overcome to initiate or improve their programs in science. The problems most frequently mentioned were those involving supplies and equipment. Sixty-four per cent of the teachers listed such problems. Most commonly the difficulty was a lack of these teaching materials. The teachers who responded were from 25 states and the District of Columbia. Twenty per cent were from the state in which the survey was made. Only teachers of grades one through six were included, and those grades were represented about equally. There was no indication that the problems of equipment and supplies are regional or confined to any particular grade level of the elementary school.

Apparently teachers consider problems of equipment and supplies among the greatest obstacles they face. Personal experience seems to point toward the same conclusion.

PART I. INTERVIEWS WITH TEACHERS

Description of the Study

The present survey was conducted during the spring of 1949. Sixty teachers in central Connecticut were interviewed to determine what problems involving concrete teaching materials these teachers consider vital in their own circumstances. The teachers were selected from 39 elementary schools in 29 cities, villages, and rural areas. No specialists in science were included, but all of the teachers reported they do teach science as a part of their programs. The amount of science taught varies considerably. The teachers interviewed were not a random sampling of any given population. An effort was made to represent equally grades one through six of the elementary school. Since problems tend to be somewhat typical of an entire school or school system, not more than two interviews were conducted in any one building, and the number in any one city or village was limited. The size of community ranged from rural to a city of 166,329 by the 1940 census. The size of school building varied from one room to 26 rooms. The median number of occupied classrooms was 10, and the median size of community was 5,313. The majority of the teachers interviewed taught but a single

* Based on the author's doctoral study sponsored by Professor Gerald S. Craig, Teachers College, Columbia University. Paper presented at the Atlantic City meeting of the National Association for Research in Science Teaching, February 28, 1950.

[1] Theresa J. Lammers. "One Hundred Interviews With Elementary School Teachers Concerning Science Education." *Science Education,* XXXIII (October, 1949), 292–295.

[2] Charles W. Quaintance. "Oregon Surveys Its Teaching of Elementary School Science." *Science Education,* XXVIII (December, 1944), 265–268.

grade, while ten of the teachers had two or three grade levels represented in their rooms.

Ordinarily the interviews were conducted in the classroom during an intermission, or while the children were at work. In a few cases a substitute was secured for the teacher while the interview was conducted; some of the interviews were conducted before or after school hours.

As a basis for interpreting the financial status of the school district, the annual salary and years of experience were obtained from each teacher. None refused. The salaries ranged from $1440, paid to a full-time substitute, to a maximum of $4400, the median being $3200. The years of experience ranged from 1 to 40, the median being 14.5.

Questions Asked, with an Informal Tabulation of Responses

1. Do you feel that science is a subject appropriate for elementary School work? Why?

All considered science instruction appropriate, the most common reason given being that science appeals to children, deals with the child's experience, and is significant in life today.

2. During the past year has your class work been concerned with the stars and planets? With rocks and soil? Animal life? Plant life? Light? Sound? Gravity? Magnetism? Electricity? Chemical and physical changes? Air and weather? Heat and energy? Machines? The relation of science to people's lives?

The median number of areas taught was 8. Air and weather was taught by 57 teachers, plant life by 55, animal life 52, stars and planets 40, rocks 40, science in people's lives 39, magnetism 38, electricity 33, light 30, gravity 25, heat and energy 23, sound, 21, machines 20, chemical and physical changes 18.

3. What problems do you face and feel must be overcome in order to improve the science program in your class?

The median number of problems reported was 2, with a lack of concrete materials reported 35 times, lack of reading materials 17 times, lack of time 16, lack of work space 10, inadequate teacher background 6, lack of storage facilities 4, and 14 miscellaneous responses.

4. Are you encouraged by your associates to use concrete materials, to do experiments? In what way?

Of the 60 teachers, 41 reported they are encouraged to use concrete materials, 17 were not encouraged, but none were actually discouraged. Four mentioned that other teachers are cooperative in lending materials.

5. Does the school budget limit you from obtaining a reasonable quantity of materials? In what way? Are there other limitations?

The budget is considered a limiting factor by 28, but 23 others consider it no limitation. The remainder gave answers somewhere between, considering the budget only a partial limitation.

6. How do these limitations, or the lack of them, compare with the situation in other areas of the curriculum?

Science is more restricted than other subjects by a lack of materials, according to 28 teachers, while 29 considered the situation similar in all areas. None reported science better equipped, and many of the 29 considered the situation bad in all areas.

7. Would you expect to receive virtually any materials, within reason, which you might request for next year?

Twenty-nine people would expect reasonable requests to be granted, while 23 would not. Five would expect a partial response, and the remaining 3 were uncertain.

8. In the past year what concrete materials have you used in studying the topics noted in question 2?

The topics noted include all areas of science. Thirty-three people reported having used five items or less, while 24 more reported using from six to ten concrete articles which they could recall. Two people reported more than ten.

9. Which of the following materials would you make use of, if they were easily available? Alcohol lamp? Animal cage? Aquarium? Barometer? Copper wire? Iodine? Magnets? Rubber tubing? Prism?

The number of items the teachers would use range from 1 to all 9, the median being 5. In most cases the use would be somewhat more extensive in the higher grades.

10. Which of the items in question 9 are furnished by the school and are at present easily available?

Forty-one people reported none of the items furnished by the school and easily available. Two commented that some items might be borrowed from the high school.

11. Which of the items in question 9 in the past year have been supplied by the teacher? By the children?

Twenty-two reported none furnished by the teacher; 15 reported none contributed by the children. One commented that all are furnished by the school. Aquaria were furnished by 15 teachers and by ten children, magnets by 20 teachers and 22 students; prisms were supplied by 15 of the teachers and by 2 children; altogether 84 items were furnished by teachers, and 50 of the listed items were supplied by children.

12. If available, what purpose might each of the items in question 9 serve in an elementary class?

Of the 60 teachers 45 understood the purpose of an animal cage, 44 the aquarium, and 42 the barometer. The least familiar item in the list was the iodine, in regard to its elementary science usage. The median for all items was 38.

13. If the items in number 9 were on hand, and others like them, how would it affect your teaching?

Comments	Frequency of Response
Would create interest	20
Make subject understandable, effective	18
Make teaching easier, more enjoyable	14
Could do more with science	10
Children like to work with real materials	10
When an interesting problem arose, it would not have to be postponed	7
Would make the subject real	7
Would serve as illustrative material	5
Wouldn't use all the materials, but some	1
Object lessons could be taught	1
Total	93

14. How much was spent per room for materials last year? The year before?

Forty teachers reported nothing spent last year, and 42 reported nothing spent the year before. Five reported small amounts spent last year, and 3 reported small amounts spent the year before. The other teachers were uncertain.

15. What materials are most needed for your elementary science program? Name three items.

Forty-three different items were mentioned, the most common being the aquarium, mentioned 23 times, magnets 13 times, a barometer 9 times, alcohol lamp and dry cells each 7, a cage 6 times, and a mineral collection was mentioned 5 times. Mentioned 4 times was a microscope, cupboards and tables, rubber tubing, and a variety of containers. Mentioned 3 times were display cases, an electric hot plate, thermometer, and planting frames. A special science room was mentioned twice, as was copper wire, display materials, test tubes and beakers, a terrarium, and a magnifying glass.

16. Have any children's toys been used for instruction? If so, what toys and for what purpose?

Twenty-one teachers reported no toys used. The remaining people reported 39 separate items.

17. What common materials from the neighborhood, other than toys, have you used for instruction in any area of the curriculum? For what purpose was each used?

Twelve teachers reported nothing used. Several mentioned that a number of items had already been pointed out in question 8, yet here many teachers thought of articles used which they had not recalled previously. Most frequently mentioned were stones, 26 times, plants 15, flowers 11, seed 9, animals 8, leaves 7, insects 6, frogs and toads 5, shells 5, soil, fish, and turtles each 4 times, tree branches, tadpoles, caterpillars, cocoons, and birds' nests each 3 times.

18. What do you have available as a source of heat for experiments? Is it satisfactory?

No source of heat available was reported by 29. Six use candles, one considering them slow, one satisfactory, and two unsatisfactory. Electric hot plates are used by 22; of that number, 12 consider them satisfactory, 3 satisfactory for some purposes, and 4 unsatisfactory. Three use alcohol lamps and consider them satisfactory.

19. Are there any restrictions on your use of materials? If so, what are they? Are there restrictions on the use of fire? Chemicals? Animals in the classrooms? Other restrictions?

Forty-six teachers reported there were no restrictions. Six reported restrictions on the use of fire. One said the janitor objected to animals. One mentioned restrictions on field trips, and three others reported "some" restrictions.

20. Are your storage facilities adequate for science materials? Explain.

Twenty-one reported storage facilities adequate, 29 inadequate, and ten fair.

21. Is having children bring in materials effective? In what way? Can you depend upon their bringing in materials when needed?

Forty-nine teachers consider children's contributions effective, 7 somewhat effective, and 4 do not consider them effective. As a source of materials when needed, 19 teachers consider children dependable, 15 sometimes dependable, and 11 not dependable. Thirty teachers commented that permitting children to contribute develops interest. Five said children like to help, 4 that home interest is stimulated, and 3 that children should learn to cooperate, while 3 others said that children bring the wrong things.

22. To what extent has it been necessary for you to purchase your own materials?

Thirty-seven teachers seldom need to purchase materials, 8 occasionally, and 11 commonly. Four more reported they have done without materials rather than purchase their own.

23. Do you know how to order materials from a scientific supply catalogue? What problems do you face in making out an order?

Of the 60 people interviewed, 18 reported they have ordered from a scientific supply catalogue at some time in the past; 6 never have, but expressed confidence in their ability to do so. A large but unspecified number stated that orders are not made out by the classroom teachers in their school system.

24. Have you ever used a science supply kit? Would you prefer to purchase a kit or to order separately the items you need? Why?

Of the 60 teachers, 10 have used kits, but 12 would prefer them. Twenty-one teachers would prefer to order items separately, while the remaining 17 were uncertain. Of the 10 who have used kits, 3 preferred them, but 7 preferred to order separately. An unspecified number of teachers commented that they would like to have materials from any source. A kit would not meet their particular needs, 15 reported; while 5 reported they favored kits, because a kit has what is needed. The kit is simpler, more compact, 4 reported; while 2 reported that a kit is not needed for grade one, 2 that ordering separately is preferred, since some items are used more than others; and 2 said they would begin with a kit and order additional materials. Five miscellaneous comments were also recorded.

25. If tools, materials, and the necessary directions were available, would you construct a cage for animals when your study was concerned with animal life, providing no cage were available? If not, why not? Would you construct other equipment, such as a ventilation box?

Thirty-two teachers would construct a cage, if needed, and 34 would construct other equipment, they reported. Twenty would construct neither a cage nor other equipment. Nine specified that the work would be appropriate as an activity for the children, and 5 pointed out they have in the past constructed similar equipment. Three teachers expressed the opinion they might get someone to help; and 2 would construct their own if they "wanted it enough."

26. Have you taken any field trips in science during the past year? If so, for what purpose? If not, why not?

Thirty have taken field trips; 29 have not. Two of the teachers reported 4 trips; while one reported 16 trips during the year. The other teachers have taken 3 or less. Nineteen trips were taken to observe plants, 19 to observe animals, 10 to museums, 4 nature walks, 3 to observe construction, 3 to examine rocks, 3 to farms, 2 to dairies, and 2 to observe stars. Six people expressed the opinion their classes were too large for trips; 5 said there was no particular reason for not taking trips; 3 said the administration limited them to the school grounds; 2 were afraid of accidents; and 2 said transportation was not available.

27. If a handbook concerned with the materials for elementary science were available for your use, what would you like for it to give?

Suggestions for inclusion in handbook	Frequency
Directions for experiments	21
Suggested activities	11
What to teach with materials	9
How materials are to be used	4
What to look for locally	3
What materials are needed	3
Handling and care of equipment	3
Aid in identification	2
Miscellaneous	5

Summary and Evaluation

The data presented represent the expressed opinions of 60 teachers regarding certain problems they face in teaching. Since the teachers interviewed were not a random sampling of any given population, it is obvious that generalizations developed from the data may not apply elsewhere. Nevertheless, the data are suggestive of problems and relationships which may be common to many schools.

All the teachers interviewed consider science appropriate for elementary school work (question 19); and all the comments made regarding the effect of using concrete materials were positive (question 13), thus implying the use of such material is considered desirable in teaching science for elementary schools. Fifty-eight per cent of the teachers interviewed reported a lack of concrete teaching materials as one of the problems which must be overcome (question 3). As in other studies, a lack of concrete materials was the problem most frequently reported. Many of the teachers consider the shortage of materials particularly acute in their science teaching (question 6). Thirty-eight per cent reported having to purchase their own materials or do without (question 22).

According to the reports, considerable science was taught by the teachers interviewed (question 2), yet few concrete materials were used for instruction (questions 8, 14, 16, and 17). A limited number of excursions were conducted (question 26), and good use seems to be made of children's contributions (question 21). More materials would be used, the responses indicate, if the materials were on hand, easily available (questions 4, 9–13, 19).

Apparently commercial materials are frequently more difficult to obtain than reasonable economy would justify (questions 5, 6, 7, 10, and 14), yet the picture is not all dark. Some teachers do report that needed items can be obtained if requests are made (question 7). It would seem, too, that greater use could and should be made

of local resources. Many common articles could be made more readily available if prepared or collected in advance and kept on hand in a supply room or closet. If teachers are encouraged to use concrete materials (question 4), they should take advantage of their opportunity by requesting a reasonable supply of commercial materials, and by more extensive use of common environmental materials already at hand (questions 8, 16, 17, and 26).

The teachers interviewed seem to be in need of more reference materials which include suggested experiments and other activities involving experience with concrete material (question 27).

To obtain the desired, essential materials, the reports indicate, a number of difficulties must be overcome. For some teachers the budget is a limitation (questions 5 and 7), and some have limited storage space for materials (question 20). The actual ordering may also give some difficulty (question 23), though many of the essential materials can be obtained locally. Also there may be some indication throughout the reports that these teachers are not sure which materials should be ordered and thus made available to implement the science phase of their program. Comparison of responses to questions 9–12 may suggest that the materials which the teachers are most apt to use are also the materials already most familiar to them, either because those materials are already being used somewhat, or because the purpose is otherwise known. It seems probable that the teachers are not clear and definite regarding many of their expressed needs, because they have had little opportunity to become familiar with concrete materials and their use in science teaching.

For the teachers interviewed, at least, it seems evident their science program could be moved forward, perhaps markedly so, by providing them with adequate instructional materials to further their work, and by helping them to take advantage of resources already available.

PART II. TEACHING MATERIALS RECOMMENDED

Description of the Study

To determine what concrete teaching materials are recommended for use in the science instruction of elementary schools, children's textbooks, state syllabi, and the professional literature were surveyed. All available state syllabi were used, provided the syllabus was copyrighted in 1941 or later, included a list of suggested teaching materials, or suggested activities from which a list could be compiled, and provided the syllabus was concerned with the six grades of the elementary school. In a like manner the science textbooks for children and professional books for teachers were surveyed. Altogether 25 sources were surveyed: 5 series of textbooks, 7 professional publications, and the syllabi of 13 states from New York and Florida to Oregon.

Interpretation of the Data

To reduce the length of the list, materials recommended fewer than eight times have been omitted here. The lists from the twenty-five sources vary considerably in length, expense, and completeness. In many cases items may be implied, though not included. For example, the use of lumber may be assumed where certain kinds of construction are recommended, yet the lumber may not be on the list. Omission from a list may not imply lack of approval. Many of the sources have very brief lists, but specifically emphasize that their lists are minimum lists to be supplemented by additional materials as the teacher or school concerned feels the need for such materials. None of the lists include all the many community resources commonly available. In some of the professional books not all areas of science are included; hence no recommendations for those areas were made. Not all the articles included need be purchased. Many are likely to be available without cost. Some may be constructed; for others substitutes

TABLE I

TEACHING MATERIALS COMMONLY RECOMMENDED FOR ELEMENTARY SCIENCE BY THE TWENTY-FIVE SOURCES SURVEYED

Item	Number of Recommendations	Item	Number of Recommendations
Tools	25	Wire, iron	15
Heat source	23	Balance, spring	14
Copper wire	23	Balls, large and small	14
Dry cells	22	Boxes, assorted	14
Magnets	22	Cardboard	14
Magnifying glass	22	Cord or twine	14
Thermometer, room	22	Flasks, pyrex	14
Bottles	21	Globe, world	14
Glass plates	21	Lamp chimneys	14
Jars, assorted	21	Matches, safety	14
Pans and Trays	21	Paraffin; sealing wax	14
Test tubes	20	Plants, potted	14
Tumblers	20	Flashlight bulbs	13
Animals in school	19	Electric sockets, small	13
Candles	19	Microscope and slides	13
Flashlight	19	Mirrors	13
Flower pots	19	Bulbs, flower	11
Glass tubing	19	Metal, copper sheets	11
Iron filings	19	Paring knife	11
Rubber tubing	19	Barometer	10
Stoppers, cork	19	Bolts	10
Terraria; aquaria	19	Cages, animal	10
Alcohol, denatured	18	Starch	10
Iodine	18	Clay, modeling	10
Dishes	18	Electric lamp; cord	10
Seeds, beans, etc.	18	Teakettle	10
Balloons	17	Thermometer, chemical	10
Compass	17	Beakers	9
Electric bell	17	Cellophane, colored	9
Tuning forks	17	Household ammonia	9
Salt, table	16	Litmus paper	9
Cloth, silk, wool, etc.	16	Pump, bicycle	9
Electric switches	16	Rock collection	9
Funnels	16	Rubber rod or comb	9
Stoppers, rubber	16	Screws	9
Tin cans	16	Tacks, carpet	9
Baking soda	15	Ant house	8
Lime, slaked	15	Cup, metal	8
Sugar	15	Electric motor	8
Vinegar	15	Iron stand; clamps	8
Needles, assorted	15	Lumber	8
Prism, triangular	15	Machines; toys	8
		Pulleys	8

may be found or improvised. In a particular school, local circumstances will have much to do with what materials are actually needed. The list of items in Table I are the ones found to be recommended most commonly.

Commercial Materials

To suggest some possible sources of the materials which may have to be purchased, a survey was made of the local stores in one Connecticut city and of scientific supply catalogues. Items on hand at two of the three sources checked were considered available from that type of store. Because variation among stores is great, the results can be considered no more than suggestive of possible sources.

Of 132 items recommended by 3 or more of the sources previously mentioned, 100 could be purchased from scientific supply houses; 102 could be purchased locally.

Seventy-eight items could be obtained from either source. Of the commercial items available locally, 49 could be obtained from variety stores, 13 from groceries, 52 from drugstores, 71 from hardware stores, and 42 from automobile supply stores.

Necessity of Having Suitable Materials Available

If we think of the child as an active individual with great curiosity, inclined to investigate, concerned with the immediate and the concrete, appropriate teaching materials are essential for a program adjusted to the nature of the child. If we believe that learning is an active process and that audio-visual aids help to gain effective learning, suitable teaching materials must be available. Some of the materials must be purchased, though the cost need not be great.

If in accord with the Forty-Sixth Yearbook of the National Society for the Study of Education, we profess to believe that knowledge gained should be functional, that in addition to functional knowledge we should seek to develop scientific attitudes, an appreciation of science, and a true, continuing interest in science, then teaching materials are indispensable. Such attitudes, appreciations, and interests, with attendant skills, are not likely to develop through the use of textbooks alone.

The presence of concrete materials is a stimulus to study and activity, and insures that materials will be used; for both teacher and children will then think in terms of concreteness and reality, in place of reading and discussion alone. Unless materials are on hand, the teacher must expend much time and effort in an attempt to obtain them as needed. The obstacles are often so great that very few materials are used, unless at least a portion is already on hand. If a certain amount of essential materials is easily available, other articles can be obtained as needed. A cycle of increasing interest and effectiveness is begun; for with adequate materials, children become more interested, associate their study with reality, and are far more likely to find suitable articles and remember to bring them to school spontaneously, no urging by the teacher being necessary. Plans for instruction should be flexible, but not constantly dependent upon the question of available supplies.

FIRST GRADE CONCEPTS OF THE MOON

PART II. BY INTERVIEW

GEORGE W. HAUPT

New Jersey State Teachers College, Glassboro, New Jersey

A PREVIOUS article [1] reported a study of concepts of the moon as obtained from children in free discussion. These children responded to a simple direction, "Let's talk about the moon." Analysis of their responses yielded five categories. The article developed implications of these concepts as classified by these categories.

The categories were: (1) Surface and Composition, (2) Size, (3) Motions, (4) Moonlight and (5) Phases. As exploration proceeded, the need for a more searching technique became evident. If the children had been questioned, what would they have said? To what depths could interrogation have plumbed? If concepts from free discussion had been compared with concepts from directed discussion,

[1] Haupt, George W. "First Grade Concepts of the Moon." *Science Education*, Vol. 32, No. 4, October, 1948, pp. 258–262.

what structural differences [2] would have emerged? The study to be reported sought such additional information concerning the categories.

PROCEDURE

Accordingly, these children were questioned. They were questioned by the author, individually, while stenographic records were made. Child, stenographer, and author were sole occupants of the room during the interviews.

The children were asked fourteen leading questions. The questions follow in the order in which they were presented. (1) Did you ever see a face on the moon? (2) What does the face look like? (3) Is there a real face on the moon? (4) What makes the moon look as if it has a face? (5) What is the moon made of? (6) How big is the moon? (7) Does the moon move? (8) Which way does the moon move? (9) What makes the moon move? (10) Does the sun have anything to do with the moon? (11) Does the moon always have the same shape? (12) What shapes does the moon have? (13) What makes the different shapes? (14) Do you want to ask any questions? During the interviews, at times, it was necessary to extend exploration of the concepts by means of supplementary questions.

A significant feature of the procedure is the set of the question pattern. Child psychologists warn that

> The questioning method . . . does not take account of the danger of introducing concepts which are not in the sphere of the child's thinking. The collection of material preferably should not follow a pattern set by the examiner but should be based upon records of children's spontaneous manifestations. If such manifestations show certain definite patterns, a questioning method may be developed for them, thus using as a frame of reference the structure of the child himself and not the structure of the adult.[3]

[2] Hartmann, G. W. *Educational Psychology.* American Book Company, 1941, pp. 271–273; 294–298.

[3] Wolff, W. *The Personality of The Pre-School Child.* Grune and Stratton, 1946, p. 295.

The pattern of these questions was set from the preparatory study of the children's free discussion reported previously.[4]

THE CONCEPTS

The concepts are arrayed by their proper questions. When there is marked deviation in phraseology, the concepts are listed separately. For example, there were twenty-five responses to the question, "Did you ever see a face on the moon?". However, of these twenty-five responses there were only three distinctions. The questions follow in order of presentation to the children but the concepts are arrayed in an order of accuracy.

The concepts are arrayed, approximately, from less to more accurate. For example, consider the responses to the question, "What is the moon made up?". Reply C_1, "Cheese," is judged as less accurate than reply I_5, "Mountains." By the same criteria "Mountains" is judged as less accurate than reply K, "There is nothing up there. It's too dry, etc." While this method of array is subject to a number of criticisms, one of which is introduction of an adult logic [5], it is adopted as appropriate for purposes of this study. Another method of conceptual array, and one of considerable value, might employ differentiation in the child's use of experience [6].

I. *Did You Ever See a Face on the Moon?*
   - A. No 6
   - B. Yes 18
   - C. Sometimes I see a face........... 1

II. *What Does the Face Look Like?*
   - A. It looks like an anchor........... 1
   - B. It looks like a man to me. It has two eyes and a mouth............ 1

[4] Haupt, George W., *loc. cit.*

[5] "An examination of the contributions of genetic psychologists makes it clear that a very great number of supposed psychological observations are permeated through and through by pedagogic influences." Isaacs, S., *Intellectual Growth in Young Children,* Harcourt, Brace and Company, 1930, p. 10.

[6] Hill, K. E. *Children's Contributions in Science Discussions.* Bureau of Publications, Teachers College, Columbia University, 1947.

C. When it is full it has dots. When it is a quarter moon it is like a face—pointed nose, eyes and mouth 1

III. *Is There a Real Face on the Moon?*

A. I don't know 1
B. There is a real face on the moon.. 1
C. Sometimes there is a real face on the moon 1
D. There is no real face on the moon.. 19

IV. *What Makes the Moon Look as if It Has a Face?*

A. God cut it out 1
B. We have a book at home that shows a picture of the moon. It has like holes in it 1
C. Bumps 1
D. Craters 1
E. It looks like a face because it is far away 1

V. *What Is the Moon Made Of?*

A. I don't know 8
B. I had it in First Grade but I can't remember now 1
C. Green cheese 1
C_1. Cheese 2
D. Houses, people, mountains, trees. Just like this world 1
E. Stars and clouds 1
F. Air 1
G. Ball of fire 1
G_1. Fire 1
H. Water 1
I. It is a great big boulder 1
I_1. Sand and rocks 1
I_2. Granite and stone 1
I_3. Lava out of volcanoes 1
I_4. Rocks 1
I_5. Mountains 4
J. The sun 1
K. There is nothing up there. It's too dry. There's no water. Even if there was water, every time it would rain the sun would burn the water up 1

VI. *How Big Is the Moon?*

A. I don't know 6
B. It is as big as Glassboro 1
B_1. It is bigger than Glassboro 3
C. Two inches around 1
C_1. Half a mile or a mile 1
D. Not as big as this room 1
D_1. Big as this room 2
E. Twice as big as my rubber ball ... 1
F. Big as a princesse's thumb nail ... 1
G. Not as big as this desk 2
H. Big as a circle 1
I. Big as a star 1
J. Big as the sky 1
K. Big as the sun 1
K_1. Smaller than the sun 1
L. About as big as the earth 1
L_1. Smaller than the earth 1
M. Bigger than the world 5
M_1. Almost as big as the world 1
N. Bigger than New Jersey 5
O. Bigger than the United States 3

VII. *Does the Moon Move?*

A. I don't know 1
B. The moon does not move 10
C. Sometimes it does and sometimes it does not 1
D. A little 1
E. If the moon stood still, daylight would never come 'cause when it moves it goes around the other side of the world 1
E_1. I believe that the moon moves around because it is dark in Europe 1
F. The moon has to move the different deserts 1
G. Yes 2
H. The moon moves around the world a little 1
I. The moon and the earth move around the sun. They don't bump because they move the same way. It even could be different ways because the moon is close to the sun 1

VIII. *Which Way Does the Moon Move?*

A. I don't know 1
B. The moon moves around the sun. It takes twenty-four hours 1
C. The moon moves north; it also moves south 1

IX. *What Makes the Moon Move?*

A. I don't know 8
B. If you drive along in a car you can see the moon move 1
B_1. Us, when we move 1
C. The wind and the clouds 1
C_1. Maybe it's pushed by the wind 1
D. The earth (or world) makes the moon move around 6

X. *Does the Sun Have Anything To Do with the Moon?*

A. I don't know 3
B. No 6
C. Yes 6
D. Something. The sun has a job now and the moon has a job at night 1
E. Only half the sun—the bright part. It reflects with the world as the world goes round. The other side of the sun is a piece which is the moon 1
F. It must be the light because when I go home it hits me in the face ... 1
G. The sun makes the moon move around 1

H. The sun gives the moon it's light. The moon makes the sun cut its rays. It does something to the rays 1
I. The sun helps the moon to shine.. 1
J. Reflexes 1
J_1. It reflects from the sun........... 1
J_2. The sun reflects on the moon like a mirror 1
J_3. The sun reflects on us. It goes up and hits the moon. It goes right straight to the moon............. 1
K. If you were on the side of the moon where the sun reflects it would be near the boiling point. If you were on the side where the sun isn't, then you'd freeze....... 1

XI. *Does the Moon Always Have the Same Shape?*

A. I am not sure.................. 1
A_1. I think so........................ 1
B. Yes 5
C. Always the same shape. Round.. 7
D. Let me think on that one—no..... 1
D_1. No 8

XII. *What Shapes Does the Moon Have?*

A. I don't know.................... 1
B. It is round...................... 2
B_1. Around like a ball............... 1
B_2. It is round sometimes—you can tell by the calendar.............. 1
C. Like a mouth..................... 1
D. Half size 1
E. All different shapes. It looks real round like a banana. You can see a little bit of it............. 1
E_1. It has different shapes........... 4
E_2. It looks different. It is light in in the morning and dark makes it bright 1
F. Sometimes it is round. Some- it is just part of a circle with points 1
F_1. Round, half and the other shapes I can't remember................ 1
F_2. The way it looks in the sky. Shapes round and like a banana... 1
F_3. Quarter, half and round.......... 1
F_4. Round moon and half moon...... 1
F_5. It is round, half and whole. You can tell by the calendar.......... 1
G. Whole, half and other shapes.... 1
G_1. It has different shapes. It has a whole, a half and a quarter....... 1
G_2. Sometimes it is half and whole... 1
G_3. Quarter, half and whole......... 1
G_4. All different shapes—one half a circle and a whole circle.......... 1
G_5. Half, whole and a little skinny one 1
H. Quarter, half and full............ 1
H_1. Half a slice, half a circle and a full circle 1
H_2. A half moon, a full moon and some others 1
H_3. There's a half moon, a full moon and some others................. 1
I. The moon changes shape in weeks 1
I_1. You can see it at full but not after that 1

XIII. *What Makes the Different Shapes?*

A. I don't know..................... 13
B. The north wind is greedy and eats the moon a bite a day and the south wind blows it back........ 1
C. A fairy washes different bits of the moon and puts them up in the sky. She's the moon's laundress and washes and pastes on parts of the moon 1
D. The night. The night hides some of the parts 1
E. Clouds—I think the clouds...... 1
E_1. The shapes of the moon are made by the clouds covering the moon.. 1
E_2. The clouds make it different shapes 1
F. The sky and clouds.............. 1
G. The weather. The rain makes it change to half. The sun makes it change to whole................ 1

XIV. *Do You Want to Ask Any Questions?*

The children responded in two ways to this question. One group made statements and queried, but evidenced no desire for sustained discussion. Another group pressed for answers and pursued consequences. The two ways of response are distinguished as "Division One" and "Division Two."

"Division Two" comprises the conversations of three children. These conversations are given in the question and answer form in which they occurred. Each conversation is presented separately.

Division One

A. No 21
B. I want to know how they can tell what is on the moon if there is no plane to go up there.............. 1
C. What makes the shapes.......... 1
D. Does the sun have anything to do with the moon? 1
E. Does the earth have anything to do with the moon?.............. 1

Division Two

Q. Who lives up on the moon?
A. Scientists believe that there are no people living on the moon.

Q. Are there not even two men?
A. No, there are not even two men. There is no air on the moon, or very little. People must have air to live.
Q. How many men will go to the moon in rockets?
A. I don't know.
Q. Will you go along to the moon?
A. No, I shall not go along to the moon in a rocket.
Q. How many rockets are they going to send?
A. I have read of one rocket.
Q. How would you get to the moon?
A. So far as I know, the rocket is the only way to get to the moon.
(Interview terminated by the child.)

Q. Couldn't the people who go to the moon in rockets use a fan to get air?
A. A fan does no good if there is no air. A fan can't make air. A fan has to have air to blow around. There is no air on the moon for the fan to blow around.
Q. Couldn't you have a fan with a long cord on it and walk around on the moon with it? The cord could reach to the earth.
A. No matter if the cord could reach to the earth, there would still be no air on the moon for the fan to blow around.
Q. How does a fan run, then?
A. The fan blades push air around. The fan blades work on air that is there already. The fan blades do not make air.
Q. When is the air going away in this world?
A. Scientists say that we shall have air for a long time.
Q. Here is one you can't answer—where does God live?
A. Some people say that God lives everywhere.
Q. Could God be hiding behind that door?
A. I suppose that God could be behind that door.
Q. Does the night really hide the moon?
A. You often see the moon at night. If you see the moon at night it can't be hidden. Sometimes, though, clouds hide the moon at night.
(Interview terminated by child.)
Q. Joseph said the moon is bigger than the sun. Is that right?
A. The moon is smaller than the sun.
Q. How could the moon be littler than the sun and shine all over the world? The moon shines over my house and all over Glassboro. How could it? I was riding in a car and I saw the moon over my grandfather's farm (ten miles from Glassboro) and then again over Glassboro when I got home.
(Interview terminated by child.)

XV. *Unclassified*

A. It is hot on the moon.
B. The earth and moon are fastened by the sky. The wind is strong in the sky.
C. They are planning to go to the moon. I saw it in a magazine. There is a hollow on the moon. There are no living beasts on the moon. There is mountains.
D. The stars and moon are the same distance away. They look even.
E. I know the world moves. Sometimes when I get dizzy I feel it move. When I spin on a chair I feel it. On a merry-go-round you get so dizzy you can't walk.

ANALYSIS OF THE CONCEPTS

This analysis is made for teachers, prospective teachers, and students of child psychology. Accordingly, a balance is sought between utility, analysis, and theory. However, when but one emphasis is possible, the features selected are those that seem likely to lead to further investigations.

For each Category of this array of questions, comparisons are made between the responses given previously in free discussion.[7] Since the same children provided the data for both studies and since these children received no direct instruction after the free discussion study and before the interview study, these comparisons are especially significant. It seems that the technique of interrogation is of great importance to a proper understanding of the contents of the minds of young children.

I. *Did You Ever See a Face on the Moon?*
II. *What Does the Face Look Like?*
III. *Is There a Real Face on the Moon?*

Comparison of these concepts from this interview study with those from the free discussion study adds some detail. A child says, "Sometimes I see a face." Thus, the interview reveals an awareness of relationship of phases and surface appearance. (In

[7] Haupt, George W., *loc. cit.*

other categories of this study further evidences of knowledge of this relationship are presented.) Then, too, the frequency as revealed by the interview is of interest.

The frequency is of interest because it seems that more than one child of this grade level, and in this category, should have noted the "face" on the moon. (When these children, in this instance, spoke of "face" they did not interpret literally.) These results mean that this rhythm of lunar appearance is not yet a part of the effective environment of these children. This effective environment is significant for child learning in science because

> "An important distinction must be made between a 'geographical' environment that is technically or physically present from the standpoint of an observer and the effective 'behavioral' or psychologically real environment with which the organism is reacting. The latter is the true framework within which mental events occur." [8]

For these children, a part (markings) has not yet emerged from a whole (moon)[9] and is not functioning as effective environment. This awareness of appearance and disappearance of the "face" on the moon (an emergent part-whole relationship) could be used as a type item in a gradation of experiences comprising the mental framework, or effective environment, of normal children.

Teachers should direct the attention of little children to observations of markings on the moon. Such perceptions are bases upon which children build their concepts and their associations of concepts. These concepts are of profound significance in the mental life of the child. Our early teachers of elementary science [10] as well as our modern ones [11] emphasize the role of the moon in the thinking of the child. From observations of lunar markings the teacher can guide the child toward some of the great ideas of the race.

IV. *What Makes the Moon Look as if It Has a Face?*

The concepts obtained for this category by free discussion, and reported in the previous study, were not grossly inaccurate. The most inaccurate of these free discussion concepts was, "Clouds cover the moon and make it look like a face." The interview technique revealed more concepts, more errors and finer distinctions.

In interview the children added: "God cut it out," "Craters," "Bumps" and "Because it is far away."

The statement, "God cut it (the face) out" is an example of Artificialism [12]. Piaget finds that the average age for dominance of this type of explanation is six years. The data of this study corroborate Piaget's age placement. Artificialism is second in a sequence of five stages of explanatory progression as determined by Piaget.

"Craters" is a conceptual refinement. In free discussion the children gave "holes" as reason for the face-like markings on the moon. "Craters" implies greater differentiation of experiental background than "holes."

"It looks like a face because it is far away" is a significant statement. It implies appreciation of spatial perspective [13]. Those who study child learning in science should investigate the "becauses" they use to correlate appearance and distance. Note, in this case, the nature of the learning joined by the "because".

Teachers of little children find no difficulty in providing experiences necessary for their acquisition of correct concepts of

[8] Hartmann, G. W. *Educational Psychology.* American Book Company, 1941, p. 162.

[9] Wheeler, R. H. *Science of Psychology.* Crowell, 1940.

[10] Elliott, H. R., and Blow, S. E. *The Mottoes and Commentaries of Friederich Froebel's Mother Play.* Appleton, 1905.

[11] Craig, G. S. *Science for the Elementary School Teacher.* Ginn and Company, 1940.

[12] Piaget, J. *The Child's Conception of Physical Causality.* Harcourt, Brace and Company, 1930.

[13] Updegroff, R. "The Visual Perception of Distance in Young Children and Adults." *University of Iowa Studies,* N.S. No. 190. State University of Iowa, Iowa City, 1930.

shadow formation. And shadow formation is a key to explanations of the cause of the "face" on the moon. Essential equipment for a direct study comprises a source of light, some stones, and a white background upon which the shadows of the stones may be cast. With such equipment the teacher can demonstrate the nature of shadows and their effects. Of course, shift to explanation of constitution and appearance of the moon must be made. But classroom practice indicates that much can be done in the lower grades toward experiential enrichment of correct concepts of the moon. Simple demonstration of processes of shadow formation [14] provide the principal enrichments to the child's understanding of appearance of lunar surface.

V. *What Is the Moon Made Of?*

For this category, a comparison of the concepts as derived by the two methods of investigation reveals significant additions from the interview. The additions are: "Green cheese"; "Cheese"; "Houses"; "people, mountains, trees just like this world"; "Stars and clouds"; "Air"; "Fire"; "Sand and rocks"; "Granite"; "Lava"; "The sun." The children seemed eager to discuss the nature and composition of the moon. Indeed, the questions of this category were the first in the series to which the children responded real freely. Relative to this comparative fullness of response, students of child psychology should note that these concepts deal with details of "structure" [15].

The six responses, I–I_5, approximate adult standards of correctness more closely than any others, with the possible exception of Response K. Note the relation of these responses, I–I_5, to Question IV (What makes the moon look as if it has a face?). This relationship emphasizes the preceding instructional suggestions concerning shadow formation. Note that I_5, "Mountains," has a heavier quantitative rating than any positive response for the entire category. This set of six responses reinforces the indications that these First Grade children are ready for scientific interpretations of lunar appearance.

Response K is a valuable clue to the genesis of a child's understanding of the process of Evaporation. The understanding will emerge by differentiation within a field [16]. The child attempts to explain why heat makes water disappear. Heat-Disappear is a field within which differentiation will take place. The child explains in terms of burning because burning is the most precise differentiation possible at the given stage [17]. Evaporation has not emerged because it is a more highly differentiated concept than burning. In other words, this child will not learn the meaning of evaporation through a summation of items but, rather, through a differentiation. This child's understanding of evaporation is emerging from a whole or field and it is a vital question if this is not the way children learn all concepts of science.

VI. *How Big Is the Moon?*

In interview the children added many comparisons to the responses given in free discussion. These additional comparisons were made in terms of Glassboro, inches, miles, room, rubber ball, princesse's thumb nail, desk, circle, star, sky, sun, New Jersey, and United States. The sole comparison made in free discussion was in terms of the earth. Such terms of comparison are significant because they indicate instructional leads. Also, they demonstrate the dependence of children's thinking on the effective environment and they define that

[14] Piaget, J., *op. cit.*, pp. 180–194. Piaget discusses four stages in the child's explanation of shadows.

[15] Koffka, K. *The Growth of the Mind.* Harcourt, Brace and Company, 1928.

[16] Forty First Yearbook, Part II. National Society for the Study of Education, 1942. Public School Publishing Company. "The Psychology of Learning," pp. 165–242.

[17] Haupt, George W. "First Grade Concepts of Hot and Cold." *Science Education,* Vol. 33, No. 4, October, 1949, pp. 272–277.

effective environment. Of the thirteen items, three are celestial objects and the other ten are concrete and terrestrial (except princesse's thumb nail and circle). These data suggest that children hesitate in discussion of size until stimulated by questions.

No other category of this study shows more clearly the effect of children's experiences on the accuracy of their judgments. Wolff says that: "The child does not have the criteria of experience which lead him to separate possible from impossible happenings" [18]. These data indicate that these children lack the criteria of experience necessary for accurate judgments of lunar size.

The statements of these children concerning size of the moon show some of the interdependencies of two principles of configuration, viz., "property" and "relation." When the child says, "The moon is as big as Glassboro" a property is stated: so, also, is a relation stated. All of the statements of this study do not show this close fusion of property and relation and hence the significance of this particular category for future research. Koffka says:

> "It must also be remarked that 'properties' and 'relations' belong with different configurations. A 'property' or distinguishing feature is an evolution of the thing pattern; as a thing emerges from its background it acquires internal articulation, without thereby losing anything of its unity or totality. A 'relation' on the contrary, generally obtains between several already isolated wholes, often quite distinct things. And hence, there arises a larger whole which includes these separate things, so that in a certain sense we may consider the relation as the internal articulation within this larger whole. But the question still remains: How closely are these two principles of configuration—property and relation—dependent upon each other." [19]

Certainly, in the statements of these children concerning lunar size, these two principles of configuration are mutually dependent.

[18] Wolff, W. *The Personality of the Pre-School Child*. Grune and Stratton, 1946, p. 12.
[19] Koffka, K. *The Growth of the Mind*. Harcourt, Brace and Company, 1928, p. 356.

VII. *Does the Moon Move?*

In interview, the children added two concepts of relationship. These concepts related lunar motion and daylight (E) and lunar motion and deserts (F). Statement (E), relating the moon and daylight, is a causal substitution or blurring—the moon becomes an active cause of daylight. Probably, statement (F) refers to deserts on the moon and, if so, illustrates a use of knowledge acquired previously. But the genetic significance of these concepts is sharpened when they are compared with Statement (I).

Statement (I) expresses an accurate and comparatively advanced understanding of the motions and positions of earth, sun, and moon. When this statement is studied along with Statements (E) and (F) an interesting three step array is emphasized. However, fortunately for the student of the psychology of learning, the gaps are great. Undoubtedly, Statement (I) is most advanced. Which of the other two is least advanced? Attempt to answer this question brings to the fore a critical problem of curriculum construction in elementary science—the problem of sequence and its dependence upon the learning process. For this reason it has just been said that the genetic significance of these concepts, (E) and (F), is sharpened when compared with (I). What insights and meanings are essential to the most economical attainment of such a comparatively advanced understanding as expressed in Statement (I)?

Finally, this discussion of Statement (I) would be incomplete without reference to implications of a remark by Piaget. After presenting the conceptions of his children relative to movements of the heavenly bodies, Piaget says:

> "The extraordinary custom followed by some pedagogues of teaching the system of Copernicus to children of this age (8 to 9) has given rise to the quaintest distortions." [20]

[20] Piaget, J., *op. cit.*, p. 85.

Now, the children of this study were not taught the system of Copernicus; they are younger than those investigated by Piaget; and, here, but one case is cited. Yet, it is these very differential Factors that seem to emphasize a need for caution in acceptance of Piaget's remark as a conclusive argument against teaching the Copernican System to young children. For, from these children of average age six years comes a statement that is anything but a "quaint distortion." What might come after instruction? The question bears investigation. The concepts of spatial relationship involved in Statement (I) provide an excellent basis for formulation of lessons to test the implication suggested by Piaget.

VIII. *Which Way Does the Moon Move?*
IX. *What Makes the Moon Move?*

Relative to the first question, i.e., direction of lunar motion, these children added one concept to those obtained from free discussion. A child said: "The moon moves North. It also moves South." Why no mention of East or West? Is it possible that North and South are more familiar to children of this age level than East or West?[21]. Children's spatial orientations should be investigated. Certainly, these children evidenced a pronounced lack of knowledge of direction of lunar motion.

Relative to the second question, i.e., cause of lunar motion, these children added several concepts to those obtained from free discussion. They said: "Us, when we move"; "Wind"; "Clouds"; "Earth." Each of these concepts leads to important categories of child causality.

The concepts are of special interest when studied in connection with Piaget's categories of children's explanations of the motions of the heavenly bodies[22]. Piaget believes that "the explanation of movement is the central point to which all of the child's ideas about the world converge." Further, he believes that "the distinction between a body's own movement and that which is determined from outside is only reached after much groping and many difficulties." He analyzes his children's explanations of motions of the heavenly bodies and arrives at five evolutionary stages. The statements from the children of this study agree with some of Piaget's conclusions concerning the evolution of such causal concepts.

Thus, "Us, when we move" can be interpreted as Animism[23]. The child believes that people have power to make the moon move and that the moon obeys us consciously. Data from this study indicate a need for investigation of the relation of concepts of Animism to socio-economic status of the child. Likewise, there is need for investigation of the relations of Animism to the emotional and intellectual status of the child.

The statements, "Wind" and "Clouds" and "Earth" can be classified, inconclusively, as Artificialism. For Piaget, this is a more advanced type of explanation than Animism. It is his third stage. The inconclusive nature of the classification results from a lack of evidence of admixture of moral and physical reason. Such admixture is necessary to Piaget's definition. Nevertheless, these three statements are best classified as Artificialism. It is possible, of course, that further questioning would have elicited the admixture necessary for a conclusive classification of Artificialism.

X. *Does the Sun Have Anything to Do with the Moon?*

In answer to this question, the children added two significant concepts to those obtained from free discussion. The two concepts are expressed in statements (E)

[21] Ames, L. B., and Learned, J. "The Development of Verbalized Space in the Young Child." *The Journal of Genetic Psychology*, 1948, 72, 63–84.

[22] Piaget, J., *op. cit.*, pp. 60–86.

[23] Also, it is a form of Participation. See: Levy-Bruhl, L., *Primitive Mentality*. The Macmillan Company, 1923.

and (K). Statement (E) expresses an idea that is noted in classroom discussions with young children, i.e., the idea that the moon is located on one side of the sun. This "two-faced" arrangement seemed to satisfy the mechanical sense of these children. As for statement (K), while the concept is correct, it indicated prior instruction. Students of the psychology of elementary science might consider the extent to which instruction could correct statement (E) and progress statement (K).

XI. *Does the Moon Always Have the Same Shape?* XII. *What Shapes Does the Moon Have?* XIII. *What Makes the Different Shapes?*

Relative to the first question, the responses from interview did not differ materially from those given in free discussion. As suggested [24], concepts relative to the shapes of the moon define an area where teachers should emphasize observation on the part of the child. The time span of one month is not too long for young children and the changes of form are sufficiently obvious for them to note and describe. It seems that children of the age levels here studied should be able to discuss the sequences of lunar changes and be able to respond to simple interrogations concerning such changes.

Relative to the second question, the children went beyond the responses that were given in free discussion. They added: "Like a mouth"; "Quarter, half and round"; "You can tell by the calendar"; "The moon changes shape in weeks." These additions are significant because of the implicated time sense. The relation of lunar change to the calendar and to the divisions of the month presents an area of learning that is rich in possibilities for elementary science.

Also of significance, are the analogies used by the children in their responses to this second question. Note: "Ball"; "Mouth"; "Banana"; "Part of a circle with points"; "Skinny"; "Half a slice." Elementary school teachers should have access to lists of children's analogies pertaining to all areas of science. The determination and formulation of such lists presents a project worthy of the efforts of our best research students. Children's analogies provide a basis for teaching new concepts as well as for clarifying those that are comprehended inadequately.

When these children responded to the third question, they added concepts to those given in free discussion. They attributed causal action to the following: "Northwind"; "Southwind"; "Fairies"; "Night"; "Weather." But, more noteworthy than the statements of these objects and forces are the contexts in which the actions are described. One example will serve to illustrate the characteristics of all: "The north wind is greedy and eats the moon a bite a day and the south wind blows it back." The characteristic is unmistakable—these responses are remarkable for play of imagination.

Now, this play of imagination is of great importance in children's formulation of hypothesis [25]. It seems, sometimes, that imagination is *the* most important factor in children's thinking. Stern says:

> "This mutual intermingling of imagination is a fundamental fact, the full significance of which has only been recognized in the last ten years, and yet it is the source of the most important psychological knowledge of equal significance in the highest form of imagination as evidenced in art, and in the simplest in primitive man and in the little child." [26]

There is need for study of the roles of imagination in various levels of children's thinking.

The conversations of Divisions One and

[24] Haupt, George W. "First Grade Concepts of the Moon." *Science Education*, Vol. 32, No. 4, October, 1948, pp. 258–262.

[25] Haupt, George W. "A Neglected Factor in the Teaching of Elementary Science." *Science Education*, Vol. 23, No. 1, January, 1939, pp. 31–34.

[26] Stern, W. *Psychology of Early Childhood Up To The Sixth Year of Age.* New York, 1930. (Rev. Ed.)

Two present concepts that should be explored by closer interview. Examples of such concepts are contained in the discussions concerning the electric fan and the sizes of sun and moon. These particular inquiries evidence a determined effort on the part of the children to reach higher levels of understanding. Students of children's thinking in the areas of the sciences should investigate such thrusts and progressions toward meaningfulness [27].

[27] Brownell, W. A., and Hendrickson, G. "How Children Learn Information, Concepts and Generalizations," pp. 92–128. The Forty Ninth Yearbook of the National Society for the Study of Education. Part I. *Learning and Instruction.* The University of Chicago Press, 1950.

THE IMPROVEMENT OF INSTRUCTION IN ELEMENTARY SCIENCE *

WILLIAM C. CURTIS
Dunbar High School, Washington, D. C.

TODAY there is a greater need for the rapid expansion of scientific knowledge than ever before. If this nation is to maintain its proper place in the coming age of atomic power, our youth must be given a well-rounded and integrated twelve-year program of science instruction. Moreover, the scientific training during the preadolescent period is of tremendous importance. It must function to counteract the early development of unscientific habits of thinking, prejudices, and misconceptions. It must also facilitate the adjustment of youth to a social order which science is making more complicated at an unprecedented rate.

The elementary teachers are responsible for the scientific training of our children during the most formative stage of their development. It is imperative, therefore, that they be thoroughly and adequately prepared for the task. They must be provided with sufficient training in science to meet the ever increasing scientific needs and interests of their pupils. If this training is to serve to improve the caliber of instruction in elementary science, it must be far more intensive and extensive than it has been in the past.

* Presented on The National Association for Research in Science Teaching program at Atlantic City, New Jersey, February 28, 1950.

THE PROBLEM

In view of the preceding considerations, the problem at issue is, what steps should be taken to supplement the scientific training of elementary teachers in order to improve instruction in elementary science?

Variations in surrounding conditions and influences affecting the life and development of children, demand certain differences in content experiences. Thus, any plan projected for the improvement of science teaching should not only take into account the general requirements of all pupils, but also the specific needs of a given locale. The present research, therefore, has been limited to an attempt to contrive a method of procedure according to local exigencies. It seems, however, that the results of this study are of national significance. There are certain specific items of preparation which must be offered in any well-organized program of science education for in-service and prospective teachers, to insure a high level of proficiency in the teaching of science. Since

these items will be closely related to the teacher's actual classroom duties, they must be suggested primarily by the teachers themselves.

THE THESIS

The elementary teachers are receiving some practical preparation from the science courses now available in the teachers colleges and universities. In general, however, these courses are not cognizant of the actual science activities carried on by the elementary teachers and, therefore, fail to provide those teachers with an appropriate basis for the planning of organized and stimulating science instruction. Furthermore, suitable opportunities are usually not provided for the in-service training of elementary teachers in science.

SOURCES OF DATA

At the outset of the present investigation, an extensive study was made of the courses of study and textbooks listed in the bibliographies distributed by the United States Office of Education that are available for use in planning a course of instruction on the elementary level. This was done to ascertain the teacher needs, as dictated by the authorities in the field of elementary science education. The outstanding research studies on the present status of elementary school science, were also carefully reviewed for the purpose of determining what improvements are needed in the procedures and practices. In this connection, an attempt was made to select only studies that involve (1) an exact delimitation of a well-defined problem directly related to the present investigation, (2) a careful and systematic selection of valid, accurate, and pertinent data, and (3) a critical evaluation and interpretation of the data collected. Finally, a careful study and analysis was made of the science curricula provided for elementary teachers in the teacher training institutions where the staff members have attained recognition as authorities in the field of elementary science education. These three preliminary sources of data provided a body of beginning materials which were used as a point of departure for further study.

Further study led to the formulation and distribution of a questionnaire among the elementary teachers of Divisions Ten to Thirteen of the District Public Schools. One aim of this questionnaire was to obtain the teachers' opinions and reactions to the present defects in the elementary school program of science studies and science offerings available to prospective teachers. Another objective was to gain an insight into the pupils' interests in science and the various ways by which they manifest such interests. It was felt that the use of a suitable inquiry blank afforded the only feasible means of collecting the needed information.

A conscientious attempt was made to follow the criteria of validity, reliability, objectivity, simplicity, and clarity in preparing the questionnaire by:

1. Making it comprehensive enough to secure the necessary data.
2. Limiting it to material relevant to the problem and worth investigating.
3. Formulating the questions so clearly that they would not be misunderstood or misinterpreted.
4. Stating the questions so that they would not prejudice the answer.
5. Limiting the requests for factual information to material either in the possession of the recipients or easily accessible.
6. Formulating the items of the questionnaire so that they called for brief replies and involved a minimum of writing.

The replies of 569 elementary teachers of varying experience and training showed that 459 teachers felt that appropriate opportunites should be provided for the in-service training of elementary teachers in science, fifty-seven were of the opinion that such training is unnecessary, and seventeen were undecided. The teacher's responses as to the form in which this training should be presented are graphically in Figure 1.

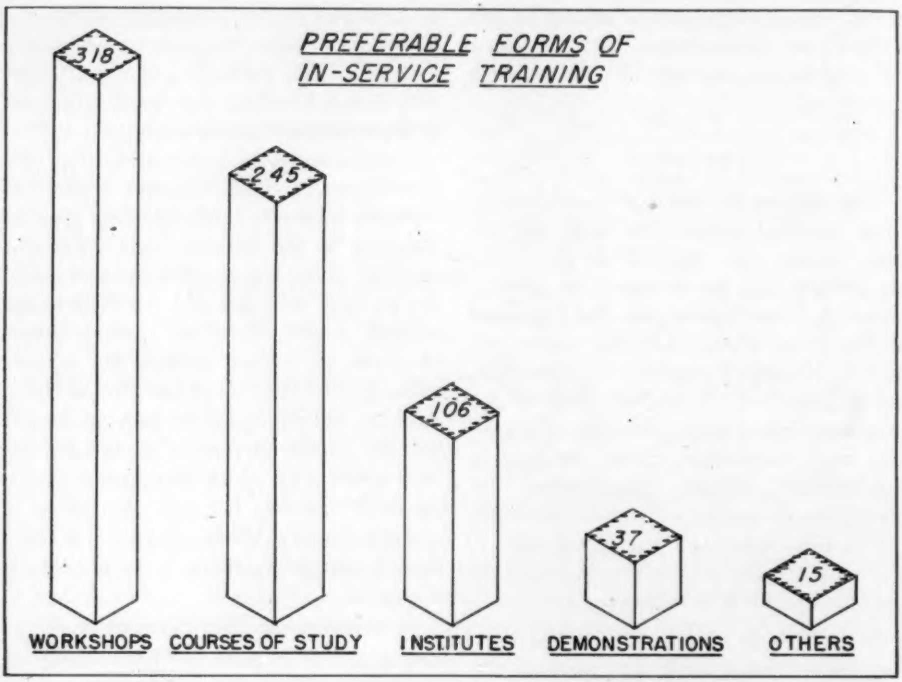

Figure 1

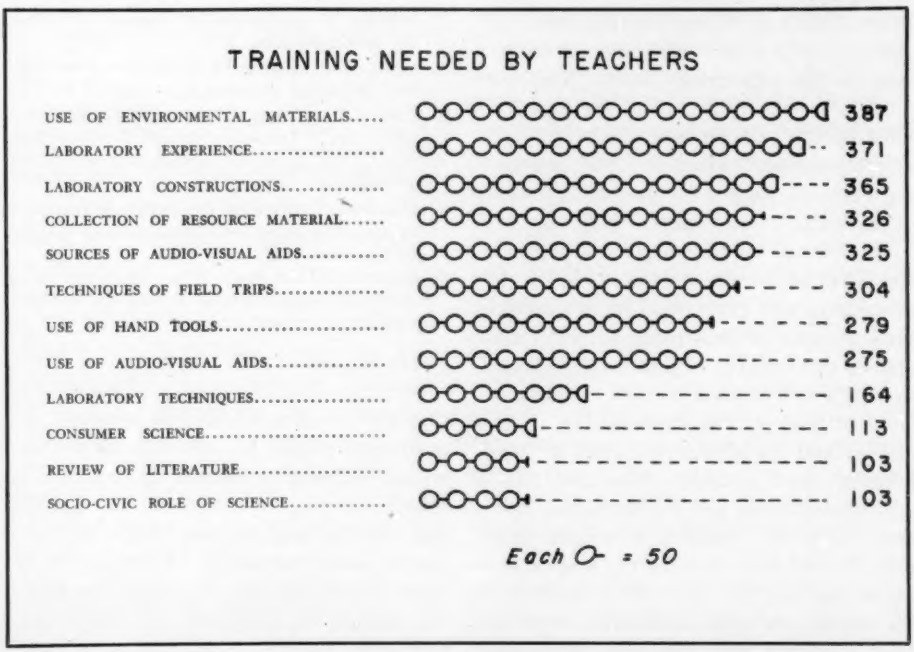

Figure 2

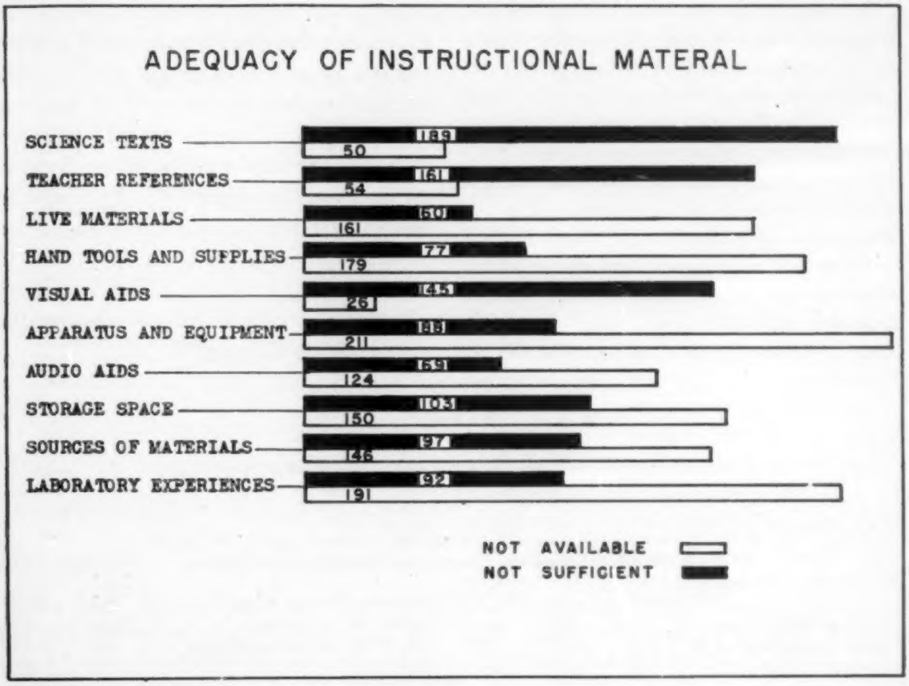

Figure 3

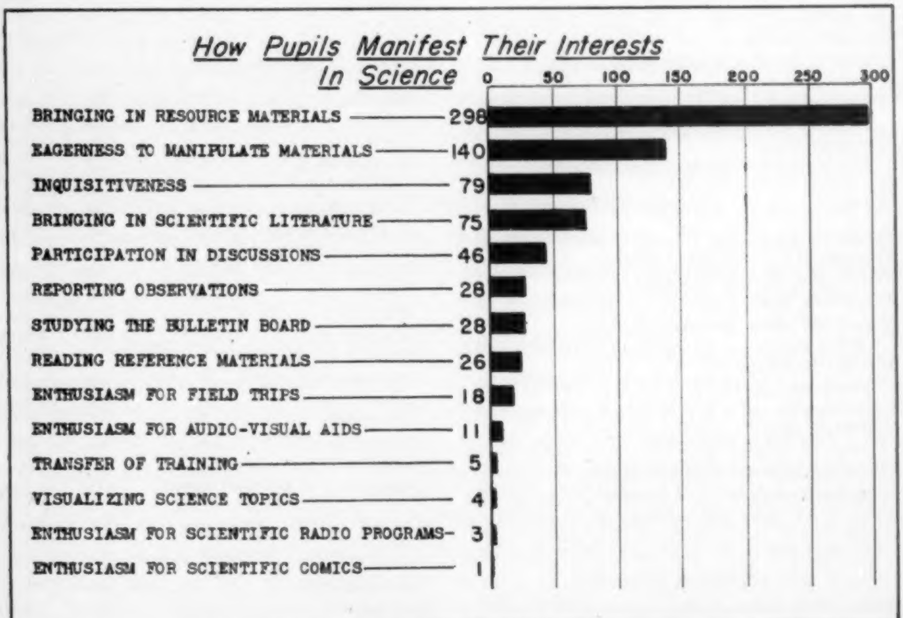

Figure 4

In response to the question as to whether the pre-service training of elementary teachers in science should be strengthened, 519 teachers answered yes, thirty-six were negative, and thirteen were of no opinion. The teacher's reactions to the need for greater stress in certain basic areas of the scientific training of prospective teachers are shown graphically in Figure 2.

Presented in Figure 3 are the teacher's responses as to whether the instructional materials indicated were either not available or available but not satisfactory in quality. In response to the question as to whether their pupils manifested a spontaneous interest in scientific subjects, 487 teachers replied yes, sixty-seven, no, and fourteen were of no opinion. The manner in which the pupils expressed such interest is shown in Figure 4. Presented in Table 1 are the responses to the question dealing with the areas of subject matter in which suitable experiments for laboratory experience would be most useful at the various grade levels.

TABLE 1

APPROPRIATE SUBJECT MATTER AREAS FOR EXPERIMENTATION

Key

P.T.—Primary Teachers (Kindergarten to third grade inclusive).
I.T.—Intermediate Teachers (Fourth to sixth grades inclusive).

Astronomy		
Practical applications	24	36
Causes of day and night	134	98
Seasonal changes	154	105
Tides	17	36
Weather, a function of the sun	139	116
Land surveys and map making	6	27
Navigation	5	9
The solar system		
Earth's shape and dimensions	49	68
Earth's motions	63	101
Atmosphere	33	66
The moon and its effect on the earth	66	75
The planetary system	29	67
Geology		
Origin of the earth	27	48
Formation of mountains and valleys	29	57
Weathering of rock into soil	66	81
Prehistoric life	36	51
Forces effecting changes in the earth's surface	40	70
Natural resources		
Coal mines	39	59
Petroleum	23	52
Mineral mines	11	30
Diamond mines	11	43
Weather conditions and their causes	85	87
Structure and minerals of the earth	30	40
Relation of rocks and minerals to us	40	69
Biological Sciences		
What living things need to exist	182	110
Effects of environmental changes	122	105
Struggle for the conditions necessary for life	78	76
Variety of living things	149	83
Social life of animals	111	80
Life cycles of living things	82	62
Food getting	153	80
Economic importance of living things	60	51
Man's influence on nature	56	60
Physical Science		
Chemical phenomena		
Burning	36	37
Rusting	23	35
Decay	35	40
Fermentation	17	21
Jet and rocket propulsion	6	22
Soap making	24	34
Properties of air	23	49
Physical phenomena		
Heat	96	63
Light	95	63
Electricity	54	69
Magnetism	32	48
Radiant energy	3	7
Atomic energy	6	13
Sound	19	40
Electronics	5	7
Machines	41	61
Physical states of matter	30	45
Changes in the physical states	25	35
Engineering		
Transportation and distribution	43	44
Communication	91	71
Production	26	48
Public welfare		
Housing and city planning	26	27
Public health	26	46

Applied Science

Man's attempt to control his environment		
Control of resources	25	45
Control of living things		
Insects	80	76
Disease germs	56	75
Control of soil nutrients	18	54
Control of soil exchanges	8	26
Betterment of the race through genetics	0	6
Science in relation to social needs		
Science and safety	131	116
Science and health	69	67
Science and warfare	15	22
Science and economics	15	22
Science and conservation	60	75
Scientific aspects of hobby	27	75
Science in relation to home needs		
Food	159	129
Clothing	149	126
Fuels	121	90
Building materials	92	79
Household appliances	128	81

DISCUSSION AND INTERPRETATION OF DATA

The data at hand does not take into account the effect of such factors as the overwhelming demands of so many subjects and activities and so much clerical work on the elementary program in Divisions Ten to Thirteen of the District Public Schools. Nevertheless, it is apparent that one of the major flaws in the local program is a lack of sufficient training on the part of many of the elementary teachers for their work in science. The teachers are, for the most part, well aware of this fact. Also, both the teachers and leading educational authorities are agreed as to the measures which should be taken to eliminate the difficulty.

Several indications of the nature of the defects in the scientific training of the local elementary teachers may be deduced from their responses to the questionnaire. For example, most of the teachers who suggested that the materials and physical equipment needed in elementary science teaching are lacking, are not sufficiently informed as to the type of laboratory experiences which should be provided for small children. Most elementary science experiments and demonstrations can and should be performed with exceedingly simple apparatus and meager supplies, which are readily obtainable from environment. The trained teacher can, also, readily solve the problem of storing meterials and making room for performing experiments in a number of ingenious ways.

Further, many of the teachers indicated defects in available science books adapted to the needs of the elementary grades and professional literature for teachers of elementary science. It is, therefore, necessary to stimulate the professional reading of many of the teachers. A considerable wealth of high-grade scientific literature of this type has been published in recent years. Elementary teachers should be encouraged to read this material through the distribution of descriptive bibliographies of selected references for both teachers and pupils. The establishment of professional science libraries in each school building is also highly desirable. School budgets should be provided for the purchase of the necessary books and references, and the principals should endeavor to stimulate the professional reading of their teachers.

Training in the use and selection of audio-visual aids is needed by many of the elementary teachers. The use of suitable audio-visual aids in connection with the grade school science teaching is of tremendous importance. No science course is complete without the use of some of the aids now available. They are extremely useful for imparting certain types of scientific information. Administrative measures are necessary, however, to make such aids more readily accessible to the local teachers.

Responses to questions on pupil interests reveal that many of the teachers need training in observing children's scientific interests and in building on them in developing a program of science instruction. As child psychologists point out, the will to grow and to know is strong among small children. Children display an almost natural tendency to seek the solutions to their problems through observation and simple ex-

perimentation. Thus, broad interests in science on the part of children is almost instinctive. In general, then, the elementary teacher's problem is not that of creating but of utilizing and directing the pupils' interests in science by providing the proper motivation and purpose.

The sixty-seven teachers who indicated that their pupils display no interest in the study of science were themselves largely disinterested in the program of science education. Hence, their responses to other portions of the questionnaire were generally negative. It is, also, interesting to note that only one teacher observed her pupils' interest in the scientific phases of comic strips. Certain comics, such as True Comics, have been highly successful in decorating scientific facts with humor and in expressing them in terms of the layman. They have a very strong appeal to young children who in modern times are prolific readers of comic strips.

It is surprising that a relatively small number of teachers indicated the need of more stress on consumer science. Most of the science now taught on all levels is presented chiefly from the point of view of the producer, rather than the consumer. Obviously, the consumer aspects of science should be given greater emphasis in our teaching program. Only a small percentage of the school population will eventually need a specialized knowledge of science. All of the pupils, however, will ultimately become consumers of goods and services, which are among the most important voluntary activities of man.

The teachers' responses to the latter portion of the questionnaire dealing with the areas of subject matter taught on their particular grade level indicate a lack of coordination of the scientific topics presented from grade to grade. Further research and study are needed to ascertain what science information can and should be taught in the various grades of the elementary schools. In order to be productive, such investigations should attempt to utilize the judgment and experience of the classroom teachers in organizing and coordinating more systematically the science offerings in the graded schools.

RECOMMENDATIONS

The findings of this study, together with those of the Strayer Committee, have prompted the author to make the following recommendations:

1. That a science workshop be established for the in-service training of the elementary teachers of Divisions Ten to Thirteen of the District Public Schools along the lines of the New York workshop plans.

2. That a professionalized course in the methods and materials for elementary science instruction be introduced into the curriculum of the teachers college primarily responsible for the training of the teachers for Divisions Ten to Thirteen.

SUMMARY AND CONCLUSIONS

It is felt that the caliber of the local elementary science program would be greatly improved by the establishment of a science workshop and the organization of a professionalized course in the methods and materials for elementary science instruction, designed to provide laboratory experience for elementary teachers. If properly organized and executed, these educational procedures would complement each other. Then too, if supplemented by appropriate supervision, they would provide practically all of the training needs of the teachers revealed by their responses to the questionnaire. Although a number of teachers indicated their preference for in-service training in the form of institutes, the use of this device is of doubtful value. Teachers' institutes are generally ineffective because they are not usually calculated to improve instruction, but rather to provide pure entertainment or to explore broad cultural topics. Moreover, the compulsory attendance at institutes decreases their effectiveness.

A professionalized laboratory course is needed to give the teachers the basic knowledge and skills necessary in selecting and devising suitable science learning exercises and activities for their pupils. In previous attempts to formulate such a course, however, the curriculum makers have failed to take into account the fact that most of the elementary teachers are women. Women usually lack the manipulative skill prerequisite to successful laboratory work and the effective use of multi-sensory aids. A course of this kind, therefore, should also afford practice in the use of simple hand tools and provide for the acquisition of basic laboratory technique and an understanding of the mechanics of audio-visual instruction. A detailed plan for such a course has been proposed for careful thought and consideration.

The establishment of a science workshop is needed to encourage and promote the continued growth of elementary teachers in their ability to direct the science learning activities of their pupils. Workshops have the advantages of freedom from regimentation and unnecessary formality over courses of study. They also afford a very good technique for getting teachers to work together. The New York workshop plans seem to afford a suitable basis for the establishment of a science workshop for the in-service improvement of local elementary teachers.

The author feels that the data which has been presented in this writing supports the conclusions which have been drawn in regard to the nature of the improvements which should be undertaken in the elementary science program in Divisions Ten to Thirteen of the District Public Schools. The improvements needed here, may, of course, differ widely from those that can and should be made in the other divisions of the local public schools or in some other school community.

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23. Robertson, M. L. "Proposed Research Problems in the Field of Elementary Science." *Science Education*, 31, 206 (Oct., 1947).

24. Russell, D. W. "How Fifty-One Well-Known Educators Answered a Questionnaire Concerning the Teaching of Science in the Elementary Grades." *School Science and Mathematics*, 38, 907 (Nov., 1938).

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APPENDIX

A Proposed Plan for

THE ORGANIZATION OF A SCIENCE WORKSHOP

The New York workshop plan presents a suitable basis for the organization of science workshops for elementary teachers in most communities. In order to plan such a workshop, a highly qualified person should be appointed to act as coordinator of activities. A science consultant should also be appointed for each elementary school. If possible, such consultants should be elementary school teachers who are particularly interested in science, and should be so selected that all grade levels are represented in the workshop. These consultants and the elementary science teachers should meet with the coordinator periodically and exchange experiences, discuss classroom problems, and cover demonstrations and experiments that have been used successfully on each grade level. They should also preview and discuss audio-visual aids which are adapted to elementary science teaching. After each meeting the science consultants should prepare a bulletin for their respective building on the outcomes of the conference. The science consultants should, also, act as a clearing house for their particular building. To this end, they should ascertain the science problems of the individual teachers and offer assistance in their solution, working cooperatively with the building committee on audio-visual aids to provide suitable learning aids.

The science workshop should call in science specialists when needed. These specialists could probably be recruited from the science staffs of the local high schools and colleges. Brief digests of scientific research, special articles of interest to teachers, practical suggestions for science learning exercises and activities, resource units, instructional guides, bibliographies for independent reading, etc., should be prepared, duplicated and disseminated as one of the workshop activities. Teachers' conferences with science specialists should also be held in connection with the workshop.

A Proposed Course in

THE METHODS AND MATERIALS FOR ELEMENTARY SCIENCE INSTRUCTION

A Two Semester Professional Course for Teachers of Elementary Science

Objectives:

1. To provide a basis for the development of skills in the construction of simple equipment and in handling apparatus.

2. To provide a basis for the effective utilization of resource materials in teaching science.

3. To provide practice and training in the preparation of suitable teaching aids.

4. To provide practice and training in the operation and care of audio-visual aid equipment.

5. To afford practice in the evaluation of pupil reference material and the preparation of typical teaching units.

6. To equip teachers to develop ingenuity, inventiveness, and reliance in awakening science interests among young children.

The Recommended Teaching Outline: The teaching outline which follows is based on the suggestions of experienced classroom teachers and well-known authorities in the field of science education. It is fully realized that it is by no means perfect. There is, no doubt, considerable room for improvement. It is felt, however, that this outline offers a suggestive blue print for a professional course for teachers of elementary science that has considerable functional possibilities. In actual practice, however, it would have to be revised and implemented to meet a given local situation. The scope and detail of the subject material to be included would be determined to a large extent by the interests and backgrounds of the members of each particular class and the interests of the immediate time and community. Then too, certain other factors would also have to be taken into account, such as whether other courses in subject matter will precede this course, whether it is for teachers in service or in training, whether it is for teachers in grades 1–6 or grades 1–8, etc.

Adequate stress could be placed on scientific methods and related attitudes and skills as the proposed course develops rather than to include them in a separate section. The actual classroom experience could also be supplemented by correlated and related reading and field exploration.

Suitable laboratory and library facilities would be required for a course of this type. The former should be sufficient to provide the practical training and experience required to equip teachers with the most effective methods of imparting scientific information to young children. Hence, all of the materials and apparatus associated with elementary science teaching should be made readily available. A library of appropriate teacher and pupil reference materials should also be provided for use in connection with the coursework.

FIRST SEMESTER

Selection and Organization of Subject Matter in Elementary Science

- Criteria for selection of subject matter
  - Scientific interests of children
    - Nature and psychological basis
    - Detection
    - Utilization
  - Scientific needs of children
  - Scientific needs of consumers of goods and services
  - Scientific principles, facts, and generalizations suggested by authorities
  - Scientific principles and generalizations which have contributed most to the progress of civilization and the welfare of man
- Organization of the elementary science curriculum
  - Science as an integral part of the activities of the elementary school
  - Areas of experience to be explored by young children
  - Selection of curriculum units
    - Subject matter units
    - Experience units
  - Evaluation
  - Sequence, length, and integration from grade to grade
  - Planning
  - Determination of outcomes

RECOMMENDED READING

1. Beauchamp, W. L. "Special Methods and Psychology for the Elementary-School Subjects: Science." *Review of Educational Research*, 7, 508 (1937).

2. Branley, F. M. "Can You Answer This? Questions in Elementary Science." *Grade Teacher*, 61, 46 (June, 1944).

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——— *A Second Digest of Investigations in the Teaching of Science.* Blakiston, 1931.

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21. Nicholos, H. "The Teaching of Science in the Elementary School that Uses the Unit Method of Instruction." *School Science and Mathematics,* 35, 63 (Jan., 1935).

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23. Pollack, C. A. "Children's Interest as a Basis for What to Teach in General Science." *Educational Research Bulletin,* Ohio State University, Vol. 3, Ohio State University, Jan. 8, 1924, p. 3 *et seq.*

24. Robinson, M. L. *A Basis for the Selection of Course Content in Elementary Science.* University of Michigan, Ann Arbor, Michigan, 1934.

25. *Science in the Elementary School.* California Department of Education, Division of Elementary Education, Sacramento, California, May, 1943.

26. Scott, F., and Meyers, G. C. "Children's Empty and Erroneous Concepts in the Commonplace." *Journal of Educational Research,* 8, 327 (Nov., 1923).

27. Slavson, S. R., and Speer, R. K. *Science in the New Education.* Prentice Hall, New York, 1934. Cf. Craig, G. S., Contributions to Education No. 276; also, Curtis, F. D., "A Digest of Investigations in the Teaching of Science," Vol. I, p. 204 (The Palmer study).

28. Stevens, B. *Child and the Universe.* John Day Company, New York, 1931.

29. Stormes, B. "Science for the Child." *Childhood Education,* 9, 301, 1932.

30. *The Place of Science in the Education of the Consumer.* National Association of Secondary School Principals, Wash., D. C., 1945.

The Methods of Imparting Scientific Information

- Experimentation
  - Individual experiments and demonstrations
    - Value of simplicity
    - Value of control
  - Cooperative pupil-teacher planning and execution
  - Use of simple apparatus and equipment
  - Exercise of caution in drawing conclusions
  - Application to life situations
- Observation
  - Utilization of senses
  - Importance of accuracy
  - Field exploration
    - Advance, preliminary planning by teacher
    - Unification of purpose
    - Cooperative teacher-pupil planning, execution, and evaluation
- Use of audio-visual aids
  - General considerations
    - Importance of a careful selection of audio-visual aids
    - Basis for the selection of a particular aid
      - Application to courses of study
      - Appropriateness
      - General teaching value
      - Technical quality
  - Types of audio-visual aids
    - Films, lantern slides, and film-slides
      - Preview and selection
      - Preparation of class
      - Follow-up discussion
      - Evaluation
    - Pictures from magazines and other sources
    - Models
    - Classroom dioromas
    - Concrete material in various forms
    - Radio programs
    - Recordings and transcriptions
- Reading
  - Authenticity
  - Reading with a purpose
  - Desirability of a variety of sources of reading material
  - Selection of appropriate reading material
- Evaluation in elementary science
  - Subjective criteria
  - Objective criteria
    - Anecodtal record
    - Mixed response test
    - Interpretation of data test
    - Cause and effect relationships
    - Testing hypothesis test
    - Drawing conclusions test

RECOMMENDED READING

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3. Burgess, A. E., and Thompson, N. R. "Audio-Visual Materials for Elementary Schools," *Nat. Ed. Assn. J.,* 37, 49 (Jan., 1948). Cf., Albrecht, M., "Audio-Visual Materials in Elementary Science," *Science Teacher,* 15, 33 (Feb., 1948).

4. Curtis, F. D., *op. cit.*

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Teaching Science. The Macmillan Company, New York, 1950.

7. Hill, K. E. "Trends in Science in Childhood Education as Indicated by Educational Research." *Science Education, 32,* 251 (Oct., 1948).

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10. Pelzl, T. J. "Elementary Science Tests." *Grade Teacher,* 65, 70 (May, 1948).

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13. Reed, H. *Psychology of Elementary School Subjects,* rev. ed. Ginn and Company, New York, 1938, Chap. 25.

14. Romberg, R. M. "Improving Reading in Elementary Science." *Science Education, 28,* 279 (Dec., 1944).

15. "Science in the Elementary School," *op. cit.*

16. Sollberger, D. E. "Aids to Elementary Science Teachers." *Science Teacher,* 15, 174 (Dec., 1948).

17. Wood, B. H., and Freeman, F. M. *Motion Pictures in the Classroom,* Houghton Mifflin Company, Boston (1929); Cf. *Suggestions for Effective Techniques of Utilizing Motion Pictures in the Classroom,* DeVry School Service Bulletin No. 4, DeVry Corporation, Chicago.

Laboratory and Demonstration Techniques

- Sources of ideas for experiments and demonstrations
  - Science textbooks and workbooks for the children
  - Periodicals
    - Chemistry
    - Elementary School Journal
    - Grade Teacher
    - Industrial Arts and Vocational Education
    - Instructor
    - Journal of Chemical Education
    - Journal of Geography
    - National Education Association Journal
    - Nature Study Review
    - Science Education
    - Science News Letter
    - School Science and Mathematics
    - Teachers College Record
    - The Science Teacher
  - Federal government publications
  - State and university publications
  - Educational publications of industrial firms
  - Professional and elementary science courses of study for the teacher
- Selection of appropriate experiments and demonstrations
- Materials and apparatus associated with laboratory instruction
- Sources of apparatus and materials
  - Scientific supply houses
  - Local sources
- Laboratory management
  - Care, maintenance, and storage of apparatus and supplies
  - Long range planning for the development of laboratory facilities
- Laboratory practice and training
- Fundamental basis of laboratory technique
  - Care and use of essential hand tools
  - Finishing and preserving wood and metal surfaces
  - Simple soldering operations
  - Wiring and wire splicing
- Useful laboratory skills
  - Glass working
  - Use of common laboratory appliances
  - Mensuration
  - Preservation of plant and animal specimens
- Construction of simple apparatus and equipment for classroom use
  - Simple tools
  - Constructional materials
  - Suitable apparatus and equipment
    - Work benches and storage cabinets
    - Suitable apparatus and equipment
      - Use in developing basic concepts of matter
      - Use in meteorological experiments
      - Study of physical states of matter
      - Study of physical phenomena
      - Study of chemical phenomena
      - Study of astronomy
      - Study of geology
- Evaluation, use, and care of household appliances

RECOMMENDED READING

1. Barton, T. F. "Teaching Soil in the Lower Grades." *Journal of Geography,* 45, 309 (Nov., 1946).

2. Blough, G. O., and Blackwood, P. E., *op. cit.*

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9. Heiss, E. D., Obourn, E. S., Hoffman, C. W., *op. cit.*

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11. Frause and Slawson. *Gems, and Gem Minerals.* McGraw-Hill Book Company, New York, 3rd ed., 1939.

12. Lamb, B. "Strange Air Tricks." *Grade Teacher,* 64, 45 (Feb., 1947).

13. Lovering, T. S. *Minerals in World Affairs.* Prentice-Hall, Inc., New York, 1943.

14. Loomis, F. *Field Book of Common Rocks and Minerals.* G. P. Putnam's Sons, New York, 1923.

15. Lunt, J. R., and Haley, D. C. "Fire Kindling." *Science Education,* 14, 551 (March, 1930).

16. Newman, M. A. "Magnets and Electromagnets: Experiments in Elementary Science." *Grade Teacher,* 64, 66 (Dec., 1946).

17. Ransom, S. B. "Hydrogen Balloons, Winds, Weather." *School Science and Mathematics,* 44, 601 (Oct., 1944).

18. Sanderlin, M. F. "Simple Experiments with Water." *Instructor,* 55, 25 (Jan., 1946).

19. Steidtman, C. E., and Scott, A. J. "What Shall We Teach in Household Mechanics." *Industrial Education Magazine,* 28, 192 (Jan., 1925).

20. Swartz, D. J., Gunerman, M. J., and Lafon, A. *Fundamentals of Shopwork.* Henry Holt Company, 1943.

21. Todd, G. "Suggestions for Teaching Weather in the Elementary Grades." *School Science and Mathematics,* 47, 139 (Dec., 1947).

22. Woodring, M. N., Oakes, M. E., and Brown, H. E. *Enriched Teaching of Science in the High School.* Bureau of Publications, Teachers College, Columbia University, New York, 1941.

SECOND SEMESTER

Living Organisms

Use of simple keys for identification
Vital processes of living organisms
Characteristics and habits of various types of animals
  Porifera or sponges
  Corals
  Worms
  Echinoderms
    Starfish
    Sea urchin
  Mollusks
  Fishes
  Amphibians
  Reptiles
  Birds
  Mammals
Experimenting with plant life
  Foodmaking (photosynthesis)
  Transportation
  Geotropism
    Heliotropism
  Hydrotropism
  Osmotic pressure
  Hot beds

Care and Handling of Plants and Animals

Growing plants in the classroom
  Suitable receptacles
  Varieties of indoor plants
  Care of indoor plants
    Potting
    Soil requirements
    Drainage and watering
    Heat, light and ventilation
    Fertilizing and liming
    Fungicides and insecticides
    Reproduction
      From seeds
      Vegetative propagation
Growing plants outdoors
  Principles of good soil management
  Reproduction
    Vegetative propagation
    Reproduction from seeds
      Dispersal
      Germination
    Varieties of outdoor plants and their adaptations to their environment
    Care of outdoor plants
  Setting up a classroom aquarium
    Location
    Building a balanced aquarium
      Preparation of the container
      Selection of aquatic plants and animals
      Balancing the aquarium
Setting up a bog vivaria
Setting up a woodland terrarium
Care and handling of pets in the classroom

RECOMMENDED READING

1. Arey, C. A. *Science Experiences for Elementary Schools.* Bureau of Publications, Teachers College, Columbia University, 1942.

2. Comstock, A. B. *Handbook of Nature Study,* 24th ed. Comstock Publishing Co., Inc., Ithaca, New York, 1939.

3. Miller, D. F., and Blaydes, G. W. *Methods and Materials in Teaching Biological Sciences.* McGraw-Hill Book Company, Inc., New York, 1939.

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7. Timmell, G. B., and Palmer, E. L. Window Laboratories. *Cornell Rural School Leaflet,* Vol. 39, Fall, 1945, Cornell University, Ithaca, New York.

Use of Resource Materials in Science Teaching

Environmental and readily available materials
  Materials found in children's own environment
    Things found in school
    Things found around the school
    Things found at home
    Community resources

Sources of free and low cost materials
Science corner or table
Science museum
Field exploration
Science fairs
Selection and use of pupil reference material
Textbooks, workbooks, and other scientific literature written for children
Bulletin board
Scrap files and scrap books
Formation of pupil resource classes
Projection of science projects from school to community
Community sanitation
Health education
Home gardening
Insect control
Photography
Safety education
Scientific hobbies
Sex education
Stream pollution

RECOMMENDED READING

1. Blough, G. O., and Blackwood, P. E., *op. cit.*
2. Curtis, W. C. "Household Safety—A Chemistry Club Project." *School Science and Mathematics*, 43, 837 (Dec., 1943).
3. Finch, E. A. "Second Graders Learn Photography." *National Education Association Journal*, 28, 20 (Jan., 1939).
4. Heiss, E. D., et al., *op. cit.*
5. Kambly, P. E. "The Elementary School Science Library for 1946–1947." *School Science and Mathematics*, 48, 202 (March, 1948).
6. O'Brien, B. H. "An Elementary-Science Fair." *Instructor*, 58, 17 (Jan., 1949).
7. Pitluga, G. E. "Science Excursion as a Teaching Technique." *School Science and Mathematics*, 47, 460 (May, 1947).
8. Pearl, P. A. "Elementary-School Science Museum." *National Education Association Journal*, 35, 496 (Nov., 1946).
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10. Russell, D. W. "Magazines Useful as Supplementary Material in Elementary Science Classes." *Educational Trends*, 8, 30 (July, 1940).
11. Weaver, R. L. "Time for Field Trips in Science and Nature Education." Time for Science Instruction, 1946 Yearbook, The National Science Teachers Association, Washington, D. C.
12. Woodring, M. N., et al., *op. cit.*

Technique of Audio-Visual Instruction

Selection and use of audio-visual aids in teaching sciences
Sources of audio-visual aids
Local
Commercial
Federal
Mechanics of audio-visual aids
Mechanics of projection and projectors
General considerations
Basic equipment
Opaque projectors
Lantern slide projectors
Film strip projectors
16 mm. sound and silent projectors
Special attachments
Technique in the use of the stereoscope
Mechanics of basic audio equipment
Radio receiving sets
Record and transcription players
Microphone and loud speaker systems
Recording equipment
Type of recordings
Types of classroom recording equipment
Phonograph and play-back equipment
Magnetic wire recorder
Preparation and construction of visual aids
Preparation of lantern slides
Non-photographic lantern slides
Photographic lantern slides
Preparation of maps, charts, diagrams, and sketches for various classroom uses
Collection, mounting, and filing flat material
Construction of classroom dioromas
Construction or improvision of various types of bulletin boards, screens, window darkening devices, etc.
Preparation of inexpensive models for classroom use

RECOMMENDED READING

1. Branley, F. M. "What Is Radio?" *Grade Teacher*, 65, 60 (Dec., 1947).
2. Carpenter, H. A. "Experiment with Recorded Science Lessons." *Science Education*, 24, 181 (April, 1940).
3. Dent, E. C. *Audio-Visual Handbook*, rev. ed. The Society for Visual Education, Chicago, Illinois, 1941.
4. Gray, E. "Model Making for Biology." *School Science and Mathematics*, 43, 828 (Dec., 1943).
5. *Guide to Free Films*, 6th ed. Educators Progress Service, Randolph, Wisconsin.
6. Haas and Packer. *Preparation and Use of Visual Aids.* Prentice-Hall, Inc., New York, 1946.
7. Mauer, J. A. "Criteria for Selecting Motion Picture Projection Equipment." *Educational Screen*, 20, 117 (March, 1941).
8. Miles, J. A. "Radio and Elementary Science Teaching." *Journal of Applied Psychology*, 24, 714 (Dec., 1940).
9. Stone, C. H. "Plaster of Paris Molds in Elementary Science." *School Science and Mathematics*, 40, 879 (Dec., 1940).
10. Wittich, W. A. "Science Teaching Film Comes to the Elementary Grades." *Ibid.*, 45, 298 (April, 1945).

CONTENT CHANGES IN ONE ELEMENTARY SCIENCE SERIES

Bernard E. Michals
Colorado State College of Education, Greeley, Colorado

No two individualsl grow and develop identically; however each one does follow a similar pattern. The only constant factors within this pattern are the changes which affect the individual. These changes are directed by the culture in which he is nurtured. Consequently child growth and development and the factors of culture are directly related and a functional combination should exist between the two.

In recent years this relationship has become evident in the changes which have occurred in elementary science content relative to the increased knowledge of the growth, development, and interests of children. Previously it was thought that children were only interested in nature study and that the physical sciences were too difficult for them to comprehend. Recent studies have indicated this theory to be incompatible with the changing conception of the individual. Craig [1] in 1927 analyzed 6,086 questions of children in more than 80 different science areas and found their interests widely distributed in biology, physics, geology, astronomy, and chemistry. The committee [2] of the Thirty-first Yearbook not only supported a continuous science program through the grades, but also suggested that the content for elementary science be derived from these five science fields and treated about problems and situations within the experiences and maturity level of students. One purpose involved in the general education movement is to consider all phases and sections of science in teaching for the satisfactory social adjustment of the individual. These recommendations are an outgrowth of the research in science education which has revealed the most important cultural factors to consider in developing accepted social behavior in children. Consequently a new and different philosophy has evolved relative to the purpose of science subject matter in the elementary school.

What changes have occurred in elementary science content which reflect these broader concepts of child development and learning? In 1937, Decker [3] completed a study which revealed the amount, kind, and distribution of content in three series of elementary science books published in 1932, 1933, and 1935. This analysis made evident that elementary science subject matter was well distributed throughout the first six grades in forty-eight different specific areas of biology, physics, geology, astronomy, and chemistry.

The purpose of this study is to determine the changes which have occurred in elementary science content since these series were published. The results of one [4] of the three series examined in the previous analysis were selected for comparison. As in the study used for comparison the scientific facts were counted and classified within biology, physics, geology, astronomy, and chemistry in a more recent series by the same author.[5] The total of 12,826 scientific facts was then organized in table form on a per cent basis.

[1] Craig, G. S. *Certain Techniques Used in Developing a Course of Study in Science for the Horace Mann Elementary School.* Contribution to Education No. 276, Teachers College, Columbia University, New York, 1927.

[2] Craig, G. S. *The Program of Science in the Elementary School.* The Thirty-First Yearbook of the National Society for the Study of Education. Public School Publishing Company, Bloomington, Illinois, 1932.

[3] Decker, D. G. *An Analysis of the Content of Three Series of Elementary Science Books.* Unpublished Master of Arts Thesis, Colorado State College of Education, Greeley, Colorado, 1937.

[4] Craig, G. S., and Burke, Agnes. *Pathways in Science.* Ginn and Company, New York, 1932.

[5] Craig, G. S., and others. *Our World of Science Series.* Ginn and Company, New York, 1946.

TABLE 1

THE PER CENT OF ELEMENTARY SCIENCE CONTENT(a) OF SERIES II(b) AND IV(c) IN BIOLOGY, PHYSICS, GEOLOGY, ASTRONOMY, AND CHEMISTRY; THE REDISTRIBUTION WHICH HAS OCCURRED, AND THE RELATIVE AMOUNT OF CONTENT IN THE SEVENTH AND EIGHTH GRADES AS COMPARED TO THE FIRST SIX

Science Field		Series	Grades 1	2	3	4	5	6	Total	Grades 7	8	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
Biology	1	II	5.362	14.240	9.756	19.774	28.874	21.274	100.			
	2	IV	4.320	7.131	18.232	15.585	32.541	22.191	100.	35.004	43.551	78.555
	3		—1.042	—7.109	+8.476	—3.189	+3.667	+.467				
Physics	4	II	3.848	6.656	9.724	14.378	23.507	41.887	100.			
	5	IV	3.407	7.756	9.722	11.509	17.366	50.240	100.	31.405	60.208	91.613
	6		—.441	+1.100	—.002	—2.869	—6.141	+8.353				
Geology	7	II	1.023	6.978	10.376	14.029	1.936	65.658	100.			
	8	IV	1.453	5.817	.622	37.552	3.734	51.452	100.	37.137	79.668	116.805
	9		+.430	—1.161	—9.654	+23.523	+1.798	—14.206				
Astronomy	10	II		5.590	9.820	6.230	42.345	35.646	100.			
	11	IV		6.125	17.648	20.456	18.803	36.752	100.	31.909	9.544	41.453
	12			+.175	+7.828	+14.226	—23.542	+1.106				
Chemistry	13	II	6.166	1.886	14.842	30.314	26.289	20.503	100.			
	14	IV	2.256	2.670	10.593	31.732	6.206	46.503	100.	99.294	13.400	112.694
	15		—4.910	+.784	—4.249	+1.248	—20.083	+26.000				

a. Decker, D. G. *An Analysis of the Content of Three Series of Elementary Science Books.* Unpublished Master of Arts Thesis, Colorado State College of Education, Greeley, Colorado, 1937.

b. Craig, G. S., and Burke, Agnes. *Pathways in Science.* Ginn and Company, New York, 1932.

c. Craig, G. S., and others. *Our World of Science Series.* Ginn and Company, New York, 1946.

Table 1 indicates this per cent in the elementary science content of both studies, the redistribution which has occurred, and also the relative amount and kind of content in the seventh and eighth grades as compared to the first six. The horizontal columns 1, 4, 7, 10 and 13 represent the per cent of elementary science content determined in the previous analysis in the five science fields for six grades. The per cent of content in biology, physics, geology, astronomy, and chemistry of the more recent series is indicated by the horizontal columns 2, 5, 8, 11, and 14. This was determined by dividing the number of facts for each field by the total number for the entire series. The redistribution which has occurred may be readily observed in columns 3, 6, 9, 12, and 15. These figures represent the gain or loss of elementary science content in each grade over a period of fourteen years. Significant changes have occurred in the first six grades as well as the seventh and eighth. There is now more biology in the third, fifth, and sixth grades and considerable less in the first, second, and fourth. While the first and third grades remain approximately the same in physics, there is over 2 per cent and 6 per cent less content in the fourth and fifth grades and over 1 per cent and 8 per cent more in the second and sixth grades. At present 9.65 per cent and 14.20 per cent less geology appears in the third and sixth grades, with 23.52 per cent more in the fourth grade. There is still no astronomy in the first grade while significant additions have been made in the second, third, fourth, and sixth grades. The fifth grade has 23.54 per cent less than the previous series. In the more recent series there is less chemistry in the first, third, and fifth grades, while over 20 per cent has been added to the sixth grade.

The comparative per cent of science content for the seventh and eighth grades for each science field was determined by dividing the number of scientific facts found in these grades by the total number found in the first six. The percentages were then added to indicate the relationship which exists between the amount and kind of content of the first six grades and seventh and eighth. Columns 7 and 8 of Table 1, indicate this relationship. There is more science content relative to geology and chemistry in the seventh and eighth grades than the total of that found in the first six grades. The amount of biology, physics, and astronomy content is also comparatively greater for these grades.

These changes in content since the publication of the thirty-first yearbook may be considered as reflections of a desire on the part of science educators to develop a continuous program in elementary science related to the growth and development of children. The kind of individuals which we wish to develop for a democratic society depends upon the interpretations which those individuals understand as growing children. Man and his culture directs and guides these interpretations and makes it imperative that each individual satisfactorily adjust himself to society. The objectives of science education have shown their potentialities for contributing to this adjustment and consequently the changes which have occurred in elementary science content are attempts to parallel those things in a changing world which mostly influence the accepted social behavior of children.

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The primary purpose of science in the elementary school is that of assisting boys and girls to become adjusted to society. The acceptance of this purpose enables one to define science content not for training scientists or naturalists but for helping children become satisfactorily adjusted to their environment.

The Forty-Sixth Yearbook of the National Society for the Study of Education. University of Chicago Press, 1947.

The objectives of science in the elementary school may be considered as directed toward the satisfactory social adjustment of children. Further changes which have occurred in thinking relative to the purposes of science content in the elementary school may be found in chapters V, VI, VII, VIII, IX and X.

SCIENCE FOR ALL ELEMENTARY SCHOOL PUPILS *

J. C. Ferguson
Ginn and Company, Chicago, Illinois

Newspapers and magazines have reviewed the first half of the century as an extraordinary one in the development of science and the impact of this development on our way of living. Today mankind stands on the threshold of a new era in civilization due to the recent development in the field of science. It can revolutionize our civilization, or it can destroy it.

The elementary child of today knows nothing from experience of the world of fifty years ago—a world without automobiles, concrete highways, airplanes, radios, telephones, electrical gadgets for the home, and most modern machinery. The schools must accept the responsibility of doing all they can to prepare them for their world of tomorrow. This can best be done by giving them an understanding of the broad concepts of science, an elementary scientific method of thinking, and some realization of the effects of science on social living. After reading and arithmetic, science is the most important subject in the curriculum today.

Nearly one hundred years ago Thomas Huxley, the noted English scientist and teacher, convinced the London School Board that science should be a part of the elementary school curriculum. There were no science books, so he wrote them. Teachers were not prepared to teach science, so he set up a course for teachers which he taught.

Though nearly a hundred years have passed, a careful analysis of the actual science that the children are getting in a large area, both metropolitan and rural, of the Middle West, leads one to the conclusion that only a small percentage of the pupils of the entire country are getting an effective science course at all levels of the elementary school. There are many schools in this area that have excellent programs in science. There are many that have no organized science whatever, others have a narrow program, and many others have good science teaching by a few teachers who like the subject and believe it to be important.

The conclusion is inevitable that much must be done if *all* the children in America are to have a science program envisioned by the leaders in science education.

Why does this situation exist? The most common reason given for no science or a little science is that there is no time in the present crowded day's program for an additional subject.

Many courses are poorly conceived. This is perhaps the most common defect. Many administrators and teachers are not fully acquainted with the broad concept of science for the elementary school as given in the excellent science yearbooks and professional books available. Science to them is largely nature study and some units on magnets and electricity. It is not sequential. It is not organized. What is emphasized at any grade level is determined largely by the teacher's interest, though she may claim it comes from the children's interests.

Many teachers are afraid to teach science. They are afraid of the questions that children may ask. They are afraid of experiments and excursions. They are insecure in the science field.

Part of this is due to the old nature-study concept of science teaching. It is conceived as "identification." They must identify birds, animals, insects, plants, trees, rocks, et cetera. They assume the position of authority. It is based on the pupil's question, "What is it?" Most of our ad-

* Presented on The National Association for Research in Science Teaching program at Atlantic City, New Jersey, February 28, 1950.

vanced science teachers would be insecure in a similar situation. They hear about the scientific method but do not know what it means nor how to use it at the level they are teaching.

They accept sequential learnings in arithmetic, reading, and many other subjects, but in science their understanding of the whole elementary program is so meager that they are lost.

What is the remedy? The real purpose of this paper is to bring about a discussion of this question. The remedial measures are the responsibility of all these groups and individuals interested in science teaching and learning in the elementary field. These groups include this and like organizations, yearbook writers, teacher training departments in all institutions, administrators, and supervisors.

Science groups like these should accept the responsibility of convincing the administrators of the importance and purposes of science to the child—how science contributes to the general aims of education. If they are convinced of this they will somehow find time in the daily schedule for science. Typical schedules that include science in other schools should be supplied to these administrators. No effective science program can be carried out until time is given to it in the daily programs.

These groups should provide for all schools an understanding of the broad concept of science that is found in yearbooks, professional books, and in science articles in magazines. This material must be moved from bookcases into the thinking and understanding of administrators, principals, supervisors, and most of all, the teachers.

These groups should constantly suggest methods and techniques that will remove fear and insecurity from the classroom teacher. They must eliminate the "identification" concept of "What is it?", and substitute for it the "how can we find out?" approach. The teacher thus becomes a learner and a director of learning. Authority is not vested in the teacher but in objects being studied, experiences, and in books.

The training of teachers is probably the most important question at present. For brevity this paper will omit the in-service training of teachers by the local administrators and supervisors and go directly to the work of the teacher-training institutions and their contribution. At present not enough is being done for prospective teachers in this field. They are still required to take certain academic courses in science for "credit." This science is taught from an academic standpoint. In this writer's opinion these courses are practically valueless in helping the teacher who is to teach in the elementary school. It is certainly of little value in the primary and intermediate grades.

The writer of this paper doubts that this is the approach that should prevail in our training institutions. It seems that a better approach would be to study the purposes, the concepts, the sequential arrangements of concepts, the methods and techniques of teaching elementary science. While the teacher is being trained to teach the concepts that she will be developing in the elementary school, she can be given extended information as a reservoir of learnings. She will understand that these extensions of concepts and facts are not to be taught to the children as a group but because of this additional information she will feel secure when dealing with those of advanced inquiring minds. The group will become thoroughly acquainted with the instructional materials available — yearbooks, professional books, textbooks, and simple materials for experimentation. The last stage would be to divide them in groups of primary, intermediate, and upper grades for further study of the concepts, content, and methods at those levels.

If this idea of preparing teachers were common in our teacher training institutions, the teacher would be well prepared to teach at the elementary level. A credit would be

much more valuable here than a credit in academic physics, biology, or chemistry. This is being done in some schools but this should be the approach in all such schools.

Further, it is the duty of the teacher training departments to lead the way by having their departments organize and furnish personnel for in-service training of teachers in the school systems of their areas. This is being done by many institutions in other subject fields, and by a few in science. This approach in all subjects to the training of teachers—in training and on the job—will make our teacher training institutions the potent force in education that they can and should be. The training institutions should accept completely as their responsibility the fourth major purpose of The National Council on Elementary Science, namely, "To further the pre-service and in-service education of teachers in subject matter, methods and techniques of instruction for teaching science in the elementary school."

I cannot close this paper without a word about the representatives of the textbook publishers who are selling science textbooks. We are the front-line workers. We are continuously trying to convince schools without a science program that they should have one. By talking to supervisors and teachers we try to improve the methods used. We try to convince them that they can teach science and need not fear the subject. The science groups working to install and improve science in the elementary schools should work with and through our group of hard-working and hard-hitting educational missionaries. We are your co-workers.

HEALTH ACTIVITIES THAT WE HAVE USED IN THE CANYON SCHOOL TO IMPROVE THE HEALTH HABITS OF THE CHILDREN

JEROME LEAVITT
Canyon Elementary School, Los Alamos, New Mexico

LIKE teachers in most elementary schools in our State and Country, each teacher spends some time during the year on health instruction. Each afternoon the school has the services of a nurse who handles all accidents, keeps the health records, and performs all the jobs usually assigned to a school nurse. Health textbooks are available for each teacher to use with her class, and the library, which is kept open all day, has many reference books and a file section on health.

The school itself was designed and built with health and sanitation in mind. Weekly inspections by students, faculty, and custodial staff, with sanitation and safety in mind, "keep the building up". The school's own maintenance crew is ready at all times to eliminate hazards and do other maintenance work as needed.

HEALTH ACTIVITIES

A recent clothing drive for the Navajo Indians presented an opportunity for all the children not only to help others but to make a study of health and clothing needs of these people, the first Americans.

The raising of chickens, guinea pigs, rabbits, and bees by the primary grade children provides them an opportunity to care for and study the diet, habits, and growth of animals. This is indeed a phase of science as well as health, and is treated as such.

NUTRITION AND TEETH

One of the most interesting and beneficial studies undertaken this year was done by one of our sixth grades. These children bred a pair of white rats, and when their young ones were three weeks old put one

MID-MORNING FRUIT JUICE

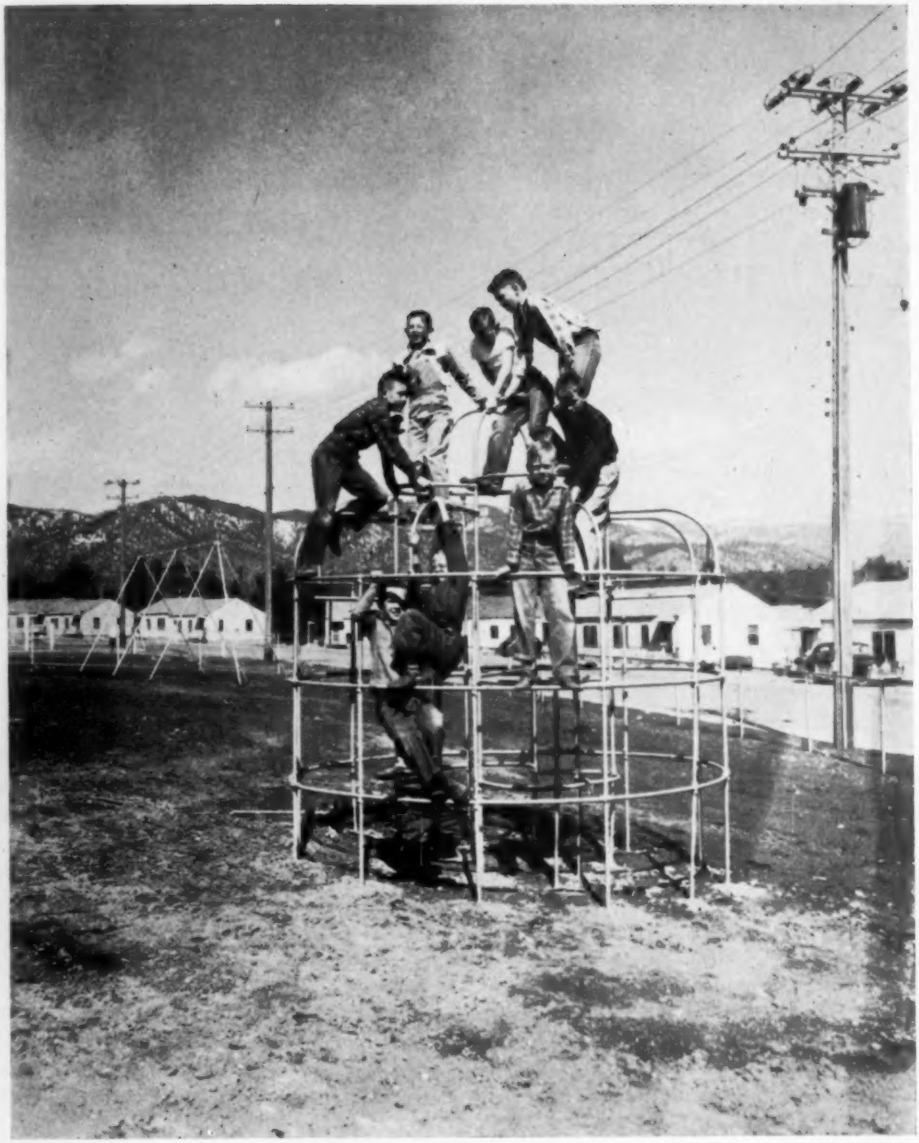
male and one female on a good diet, and one male and and one female on a poor diet. Over a period of weeks, by watching the growth of these rats as recorded on the chart, and by observing the rats themselves, they were able to see the influence of good and bad diets on growing animals. During this period of time, the students could readily see the growth and energy of the well-fed rats as compared to the poorly fed group. At the same time, the children also learned the methods of conducting a study on the care of animals.

The same grade, along with this study of foods and nutrition, undertook a study of their own teeth. Plaster casts of each child's teeth were made up by the children with the teacher's help. Then all the children had their teeth examined by the dentist and the plaster casts were marked where the teeth had caries or were deformed. The next step was for the children to make dental appointments to take care of these caries, and other treatments necessary, such as cleaning, were performed. Many children also had teeth straightened.

FOODS

Both boys and girls like to cook and the faculty capitalizes on this. Many classes go to the kitchen and prepare light lunches. One of the most interesting lunches was prepared by a first grade who cooked their entire lunch. This lunch consisted of corn, beans, and a salad, all of which were home grown. Many of the grades have their own flower and vegetable gardens which not only supply items of food for these lunches and food for the school animals, but also flowers for table and room decorations.

Fruit juice and crackers given as a mid-morning lunch to the primary children add



Good Play Means Good Exercise

to their daily diet and provide group experiences in eating. Different children take turns in setting the table and pouring the juice.

SAFETY

The reorganization and painting of our industrial arts laboratory provided the instructor with an opportunity to emphasize a safe shop and shop practices by the correct placing of safe equipment and painting it according to the Safety Color Code. This color code keeps children alert to the shop hazards and promotes their pride in having a safe and clean shop.

In connection with the local fire prevention and clean-up week, the entire school

REST PERIOD

co-operated. This year the slogan was "Clean-up, Fix-up, Paint-up, and Plant-up". Different grades chose what they wanted to work on and then went ahead with their project. These projects varied from primary children cleaning out desks to intermediate children planting school gardens.

A JUNIOR COLLEGE TEACHER FINDS AN ELEMENTARY SCIENCE WORKSHOP EDUCATIONALLY STIMULATING!

STANLEY B. BROWN
School of Education, Stanford University, Stanford, California

EDUCATORS are aware of the shift in curriculum thinking from content existing as an end in itself to an organization around problems which have social value and are contributing factors in the child's growth. In other words, a two-way process whereby there exists an interplay of curriculum materials on one side and the varied experiences of the children on the other. Many elementary school teachers are striving to achieve this important aim, and the workshop technique serves well to assist the teacher to realize this highly desirable goal.

A stimulating four week elementary science workshop was conducted at the

Stanford University School of Education during the summer quarter, 1950, under the direction of Dr. B. Frank Gillette, Assistant Professor of Education, Stanford University. Although the predominant proportion of the twenty-six workshop participants represented the elementary school level, the group included three high school teachers, a junior college teacher who, together with another teacher, are in the science education doctoral program. The group also included a director of elementary education for a rural county office of education, and two principals of nearby elementary schools.

Registration for the workshop was permitted on a unit basis to a maximum of eight graduate quarter hours, dependent upon the individual's available time for active participation. Approximately one-half of the participants enrolled for the maximum number of units and were active in the workshop during the greater part of each day. The workshop hours centered around a group meeting with the Director for a minimum two hour discussion session, five days a week, following which the workshop was available for individual research and study the remainder of the day and evening. Basic references used were: *Science Education for the Elementary School Teacher*[1], *Science Education in American Schools*[2], and *Science in the Elementary Schools*[3].

The ultimate aims of this workshop were to meet the needs of teachers seeking to strengthen their background for integrating science in the over-all elementary curriculum. The elementary teacher need not be proficient in advanced scientific material; but rather, where inadequacy prevails, should make use of opportunities to broaden and enlighten himself with functional information relative to his own specific teaching level. In order to successfully satisfy a child's native curiosity for the world about him, there is a pressing need for elementary teachers to possess a sound, basic understanding of the biological and physical environment applicable to that level.

Unfortunately, many elementary teachers possess a lack of sufficient background in science to enable them to motivate the children's interests and to maintain a stimulating wealth of scientific information as an integral part of the student's classroom experiences. Since children require only simple, direct explanations of functional information, it is very definitely a weak link in the child's educative process if a poor teaching situation develops through the elementary teacher's inadequate preparation. The Stanford University elementary science workshop sought to eliminate these weak links through the examination of basic texts and resource material, investigation of teaching techniques, participation in local field trips, and open discussion of individual educational problems. It was refreshing to observe many of the workshop participants deriving a joy that results from experiencing an understanding of material that was previously "dull," "uninteresting," "too difficult," or "incomprehensible."

Upon several occasions the workshop participants became involved with resource material beyond their scope of understanding. Many recalled, from teaching experience, specific questions asked by their pupils concerning the material. The method of solution to these problems developed by the workshop personnel was most interesting: The members worked as a team seeking the correct information from qualified sources. Where one member failed to grasp the solution, others explained their interpretation with the result that it was an enriching experience for all members.

With reference to the varied activities

[1] Gerald S. Craig. *Science Education for the Elementary School Teacher.* New York: Ginn & Company, 1947.

[2] *Science Education in American Schools.* Forty-Sixth Yearbook of the National Society for the Study of Education, Part I. Chicago: University of Chicago Press, 1947.

[3] *Science in the Elementary Schools.* California State Department of Education. Sacramento: California State Printing Office, 1945.

of the workshop during the four week interval, each member took advantage of the congenial atmosphere to discuss individual curriculum problems and philosophies, profitable teaching techniques, and future course outlines for a well-balanced science program. The discussion of teaching techniques included the various problems posed by the exceptional student, the accelerated and retarded. A survey was conducted to analyze and evaluate available free and inexpensive information; viz., pamphlets, brochures, charts, and texts. General science "kits" were carefully examined and their merits criticized. Rock specimens and live materials, particularly common plant and animal species were exhibited. Two high school life science teachers (workshop members) introduced good general laboratory and histological techniques applicable to the elementary level. Emphasis on conservation of natural resources from a local, state, national and world standpoint was stressed frequently. The Director demonstrated how a "20 questions" game-technique can be effectively used at any level. The game is patterned after the current popular radio program of the same name in which an object, known only to the moderator, is presented to the questioners as being animal, vegetable, or mineral. Through a series of 20 questions, the name of the object must finally be discovered. The moderator may answer each question only in an affirmative or negative. An excellent discussion concerned the place of facts versus fantasy found in the many resource materials. It was agreed that the teacher should carefully scrutinize the prospective teaching materials and either keep questionable material at a minimum or discourage its use in the classroom.

Three informative field trips were conducted during the workshop period. The Palo Alto Junior Museum summer program was in operation and proved to be especially enlightening, affording an actual demonstration of some of the extra-curricular activities of many elementary level children. Viewing several planets through telescopes and examining astronomical photographs and literature at the James Lick Observatory on Mount Hamilton proved to be a thrilling experience for the members. The opportunity to transcend into a completely strange world in the tide pools of the Pacific coast rock formations, to study the fascinating habitats of the varied beach and sea animals will never be forgotten by many of the members. San Andreas fault with the earth's crust ever on the move was given a new meaning as these eager and alert students examined the fault area.

The goals of this workshop were very definitely achieved. Each participant drew out of the workshop activities a better understanding of the philosophy of science education on the elementary level, an introduction to many valuable materials, sources of information, and an accumulation of useful experiences. The individual problems, techniques, and resource materials discussed in the group and individual conferences resulted profitably in terms of teacher growth and enriched educational experiences. The educative contributions of the teachers and administrators from the three levels proved to be both enlightening and challenging. All of the participators profited from broad readings in pertinent materials and research on individual topics.

The writer knows that at the high school and junior college level there exist many of the same problems that were encountered and solved during the elementary science workshop period. Could similar high school or junior college workshop members achieve such goals as a better understanding of the philosophies of science education at their level? Could the members develop greater confidence in their teaching abilities through their participation and activity in a similar workshop? Could the members, individually, accumulate worthwhile materials applicable to their teaching level? To these important questions, a most emphatic and enthusiastic, YES!

A REPORT ON THE ORGANIZATION OF THE STATE REPRESENTATIVES OF THE NATIONAL COUNCIL ON ELEMENTARY SCIENCE *

George Greisen Mallinson

Western Michigan College of Education, Kalamazoo, Michigan

One of the major aims of the National Council on Elementary Science is to acquaint the educators of the United States with the desirability of a program of science integrated throughout the various levels of the elementary school. To that end a number of activities have been undertaken by the organization. The National Council on Elementary Science has met in conjunction with the National Association for Research in Science Teaching and with the American Association of School Administrators. It has been planned tentatively to meet in the future with the Association for Supervision and Curriculum Development, and with the Association for Childhood Education.

It has been noted by the officers of the Council that the membership tended to vary greatly from year to year. While the number of members increased annually, it was found that the core of membership was small. Investigation showed that many of the members were from the district in which the convention was held. They joined and paid dues for only one year. The next year there were new members from another convention district.

During the period in which Dr. George Haupt was President of the Council, it was decided to initiate a system whereby two members of the Council from each state were appointed as State Representatives. It was believed that such representation would tend to publicize the NCES and thus stabilize the membership. The State Representatives were to represent the Council at various regional meetings, offer their services at meetings of teachers in the various states, and survey activities in the states in the area of elementary science. During the period in which Professor Rose Lammel, and Mr. Glenn O. Blough, were Presidents of the Council, the success of the system of State Representatives was scrutinized. It was found to have a number of advantages and therefore it was decided to expand its activities and exploit it where possible.

At the meeting of the Executive Council of the National Council on Elementary Science in New York City on February 14, 1949, Dr. Katherine Hill and the writer were delegated the task of recommending procedures by which the fine work of the pioneers of the system could be used to the greatest advantage, and of coordinating the efforts of the representatives.

As a result, the two coordinators contacted State Representatives, officers and members of the NCES and requested information concerning the activities being carried on. A series of recommendations were drawn up, sent to various members of the Executive Council, and then revised as suggested. The recommendations so revised read as follows:

Recommendations for Reactivating the State Representative System of the National Council on Elementary Science

Title

The individual shall be known as Representative of the National Council on Elementary Science for (name of state).

Appointment and Qualifications

1. The Representatives shall be appointed by the incumbent president of the National Council on Elementary Science for a period of two years. They may be reappointed for additional terms of service provided other qualifications are met. The appointment shall date from the beginning of the fiscal year during which that appointment was made.

2. Representatives shall be appointed from among the dues-paying members. They may be

* Reported at the convention of the National Council on Elementary Science in Denver, Colorado, February 12, 1950.

reappointed provided they pay dues at the annual meeting at the time of which their appointment terminates or express such intention on request from the president, or by a person delegated by the president.

3. The appointment shall depend upon the willingness of the individual to undertake to the best of his or her ability those tasks which are concomitant with the office.

Duties

1. The Representatives shall perform such duties as are requested by the president, a person delegated by the president, the executive board, or the board of directors. These duties may include:

a. Dissemination of information to members of the NCES in the respective states.
b. Dissemination of information concerning the NCES to non-members.
c. Participation in programs for recruiting additional members.
d. Submitting annual reports to the president, or his delegate, concerning the representatives' activities during the year.
e. Surveying activities in the field of elementary science in the respective states.
f. Presenting papers and topics at state meetings where such contacts may be made.
g. Collecting materials published in the respective states in the field of elementary science.

Additional Recommendations

1. It is recommended that the president appoint a person as his delegate to act as coordinator over the activities of the representatives. It shall be the duty of the coordinator to consolidate reports from the representatives to present to the president and to assist the president in other ways in coordinating the program. This person may be a member of the board of directors.

2. It is recommended that the president write the Association for Childhood Education, the various state and regional science teachers associations and the state education associations and offer the services of the representatives to present topics on the programs of their gatherings.

3. It is recommended that the representatives when appointed be sent a copy of the constitution, a copy of the duties they shall be expected to perform, and ways in which they may use personal initiative in furthering the cause of elementary science.

4. It is recommended that the appointments for state representatives be made from classroom teachers as well as from science specialists in college where feasible. It would be desirable that one of the two representatives in each state be a member of a public-school system.

5. It is recommended that the coordinator be allowed to exercise initiative in planning programs, initiating research, and disseminating materials. The judicious exercise of such initiative will facilitate seizing opportunities for speaking, etc.

6. It is recommended that the coordinator and state representative exert every effort to obtain published materials for duplication and mailing to other members of the NCES.

At the suggestion of Mr. Blough, representatives who had already been appointed were requested to continue their activities. A few other persons were written at the suggestion of members of the Executive Council. They were to act as State Representatives in accord with the recommendations established tentatively by the two coordinators.

The letter inviting the members of the NCES to act as State Representatives read thus:

Date

As a member of the National Council on Elementary Science, you are no doubt aware of the fact that the failure of our organization to spread its influence is due partly to the inadequacy of our methods of publicity throughout the various states. This matter was discussed at length at the meeting of the Executive Committee at the convention of the NCES held in New York City in February, 1949.

At that time, Mr. Glenn O. Blough, President of the NCES, delegated to Dr. Katherine Hill and myself the task of reorganizing the system of State Representatives so that the aims of the NCES might be disseminated to a greater number of people. Recommendations were prepared and approved. It is now our task to seek representatives from each of the states who meet the criteria set up in the recommendations. You have been selected as one of the persons to represent your state, if you so choose. We hope you will notify us of your acceptance.

The development of activities for State Representatives will be discussed at the coming meeting of the NCES in Denver in February of 1950. You will be notified later of the particulars.

We hope sincerely that you will accept the position and will participate at the coming meeting. Please feel free to invite any of your friends who may be interested.

I hope to be hearing from you.

Very truly yours,,

GEORGE G. MALLINSON
Coordinator of State Representatives
National Council on Elementary Science

GGM:dc

Most of the members so contacted agreed to act as State Representative for the Council.

This is a report of the activities of the two coordinators to this time. They wish to emphasize that further activities depend upon the acceptance of recommendations, in some form, for continuance of the plan for State Representatives. In addition, it will

be necessary to appoint coordinators officially, if the recommendations are followed.

The two tentative coordinators hereby suggest that the members of the Council act to establish the system of State Representatives as a permanent function. They believe that the recommendations here presented may well serve as a basis for organizing the activities of the State Representatives.

That which has been accomplished so far by the State Representatives seems to indicate that the system will go far in helping the National Council on Elementary Science in disseminating its philosophy and program.

TEACHING TEACHERS OF ELEMENTARY SCIENCE

Wayne G. Christian
School of Education, Denver University, Denver, Colorado

Recently it has been necessary to plan a course of study for a class of university students interested in the teaching of elementary science. The class will be composed of experienced as well as prospective elementary science teachers.

Too few present day elementary teachers have an adequate concept of the place of science in the total school program. A large number of the teachers of elementary grades have had little or no training in any science since high school days. It was with those two conditions in mind that the following list of needs was formulated and the plans for the course built around these needs:

1. The improvement of science teaching in the elementary school through the teacher education program.
2. The development of constructive attitudes toward current problems.
3. Need for teaching concepts of science rather than the mere memorization of facts.
4. The demonstration of the necessity of correlating all the activities of the various classes in a school.
5. Development of the ability of teachers to evaluate their own work as well as the child's.
6. Suggestions of methods, techniques, and materials which may be of value to both beginning and experienced teachers.
7. Help for those teachers who have not yet developed their own functional objectives.
8. Practice in preparing and demonstrating various projects which can be adapted to their own classrooms.

All portions of the work will be directed toward the solution of modern problems of our environment and the preparation of the students of today to be the citizens of a much changed world tomorrow. It will not be possible to answer all the questions which will arise, but one can try to teach persons to have inquiring minds and to attack problems logically. The attitudes children acquire during their formative years are much more important than any group of isolated facts; teachers often lose sight of that fact.

The whole class will be given the opportunity to become involved in the formulation of a science program sequence for grades 1–8 inclusive. Persons teaching at those levels will be able to contribute much toward an overall plan which correlates work to be done this year with that done last year and that to be done two years from now.

Audio-visual aids will be emphasized throughout the course, but a word of caution will also be given; caution against using films or other media just to "fill time" or to enable the teacher to loaf a bit. Correctly used they are invaluable; incorrectly used they are worthless.

In groups and/or individually all class members will be encouraged to devote considerable time to projects of functional value to their respective grade levels and specific classes. The dominant criterion will be, "Is it possible and will desirable learning probably result?" If there are grave doubts concerning any of the activities when examined with that question in mind they will be revised and attempts made to improve them or they will be discarded completely.

Instead of just talking about the desira-

bility of taking children on supervised field trips, excursions will be planned to fit into the class activities. Each person will be expected to evaluate each trip in light of its value to his or her special grade level and to a group made up of children of different grades. There will be special emphasis upon those techniques which improve the field trip as a learning activity for children. Pitfalls will be pointed out and detours noted.

In addition to the materials located by each student for sharing with the whole class, other lists of inexpensive materials will be provided. In connection with all projects and individual work, suggestions will be made for the utilization of inexpensive or free laboratory equipment. No school can ignore science just because there is not enough money to purchase quantities of expensive laboratory equipment. The available lists will be expanded and revised as students make their own suggestions.

In lieu of a final examination each person will submit an outline of the science activities they plan to direct this next year. Each plan will need to be tailored specifically to the class in which they will be teaching, insofar as is possible and feasible. The value of community and neighborhood resources will be stressed and ways will be suggested for their utilization.

During the first days of the class meetings committees will be formed for the purpose of permitting group planning and for the inexperienced persons in the class to have an opportunity to work with one or more experienced teachers. The committees will be formed after the students have submitted the following information to the instructor:

1. Name and address.
2. Previous education and psychology courses.
3. Grade level and school in which you will be teaching next year. (If you will not be teaching then please indicate if you plan to be in college or working at some other job.)
4. List of science and sociology courses completed.
5. Why are you taking this course?
6. Daily work and class schedule so field trips may be arranged.
7. For experienced teachers: a list of five science teaching problems you would like to discuss in class.
8. For those with no teaching experience: a list of five science problems you believe to be of interest to children.
9. Work experience other than teaching.
10. Travel experience, in the United States and/or abroad.

The class work will be arranged somewhat as follows:

1. Demonstration of the use of problem solving techniques on a few selected problems submitted by the students.
2. Discussion of present science teaching in our schools and some of the glaring weaknesses as well as the multitude of strengths.
3. Introduction of the concepts relating to the origin and history of the universe and our planet in particular. Time, space, change, and the interactions of organisms will be discussed, as will the theories of the origin of the earth and the geological history as we know it now. It is intended that the students will have an opportunity to study certain evidences of changes and then they will be asked to explain them in such a manner as to be understandable to a child in an ordinary classroom.
4. Natural phenomena such as earthquakes, volcanoes, geysers, hot springs, meteors, eclipses and movements of the tides will be discussed from the child's viewpoint. Ways to explain these phenomena will be suggested.
5. Each day one or more persons will have a portion of the class hour to demonstrate their projects. After the presentation the group will be asked to turn in suggestions for improvements. Each person will be asked to imagine themselves in a class of children in which the particular demonstration would be useful.
6. The importance of the study of geology and paleontology as it pertains to minerals and important fuels such as coal and oil. An explanation of the methods of determining the approximate age of the earth will be included.
7. Concepts of evolution, evidences of changes in plants and animals throughout the ages. Economic importance of coal deposits, oil, oil shales, and forests will be reemphasized.
8. The importance of genetics and concepts children can grasp: like begets like, throwbacks, mutations, and hybrids.
9. Conservation and its important implications along with plant and animal ecology. Problems of overgrazing, extinction of species, hydro-electric power, clean-cutting of the forests, burning of grasslands and the drainage of swampy areas will be considered.

Human ecology will be interwoven with all of these problems.

10. Modern medicine and disease will deserve some time as will the extremely important concepts of atomic energy, chemurgy, and electronics.

After each field trip there will be an opportunity to discuss its worth and usefulness.

At the end of the course students in the class will be allowed to evaluate their own work. The following outline is to be used:

STUDENT SELF-EVALUATION

1. List the objectives you had in mind when you began this course.
2. To what extent were those objectives attained?
3. Describe your project briefly and evaluate its usefulness for your classes this fall.
4. List the supplementary books you read; especially those you consider worthwhile for science teachers. The quantity is not as important as the quality of the reading you have done.
5. Summarize (briefly) the magazine articles you have found helpful.
6. Where on the following scale do you rank yourself? Circle only one.
   Textbook reading: all, thoroughly; all; most, but not all; some portions; none.
7. What limitations affected your work (those over which you had little or no control)?
8. Are you aware of any change or modification of your philosophy of science teaching?
9. Do you feel better prepared to face an elementary science class? If not, why not? Is so, in what ways?
10. The following question concerns your total class work. How do you rate yourself on the following scale?
    Very superior ....
    Superior ....
    Above average ....
    Average ....
    Below average ....
    Poor ....
    Very poor ....

Name ....
Home Address ....
....

Welcome comments and suggestions were made by Miss Louise Neal, Colorado State College of Education, in whose class this work was completed and Dr. Howard Woolum, University of Denver, who has had extensive experience in teaching classes of similar character.

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Parkins, A. E., and Whitaker, J. R., and others. *Our Natural Resources and Their Conservation.* John Wiley and Sons, Inc., New York, 1946.

A constructive overview of the problems of conservation in the United States. Stresses the fact that man has within his power the destruction or conservation of his resources, both human and material.

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A significant discussion of the need for better teaching education. Should be of value to those persons involved in a teacher preparation program.

ELEMENTARY PUPILS STUDY RADIO

Dorothy Waite and Richard Gibbony
The Pennsylvania State College, State College, Pennsylvania

Radio is very real to the child of today. It exists all about him as a source of information and entertainment, as a medium of propaganda, and, sometimes, as a marvel of science. Because of its potent effects on their daily lives, it was decided to embark upon a thorough study of radio when our sixth grade pupils manifested an interest in electricity.

The children had in their classroom a science table equipped with books, dry cells, wire, bells, switches and magnets with which they had been experimenting. They had learned to connect simple bell-ringing circuits with switches and dry cells. They knew how to make an electro-magnet and were experimenting in making an electric motor. Several children were interested in and had made simple crystal radio sets at home.

In the course of our two months study, we sought information on all phases of radio. Our inquiry into how a radio works resulted in a brief study of radio theory, and culminated in the building of a two tube radio. Our search for information about radio broadcasting, resulted in a study of radio writing, acting, engineering, and directing, and culminated in student-written and acted programs. At the conclusion of the unit, the children were invited to arrange for a fifteen minute broadcast over their local station.

BEGINNING OUR RADIO PROGRAM

Interest was evident and high as both girls and boys gathered about the science table talking and asking questions of each other and of the teacher, that they wanted to know more about how many things worked. One boy told about his crystal radio set which stirred the curiosities of many children. The class decided that they would like to study about radio. Work began immediately. We discussed what we knew about radio. In a short time we decided that we needed to secure more information. The children and teacher together set up a list of questions about which we needed answers. Here is a partial list of the things we wanted to find out:

1. How does a radio operate?
2. How does a voice get to our radio in our house?
3. Why do we hear people talk over the radio?
4. How is a radio made?
5. How does tuning work?
6. What is meant by radio waves?
7. How are radio tubes made?
8. How are sound effects made?
9. How are programs produced?
10. What are the qualifications and types of work of a director, an announcer, and an engineer?
11. How does F. M. work?
12. What is Associated Press?
13. What can we find out about the history of radio?
14. Why are some radio programs sponsored and some not?
15. Who are some outstanding people on radio?
16. What is an amateur in radio?
17. How is radio used?
18. What is meant by radio network?
19. What are some of the large radio stations? Where are they located?
20. What competition does radio have?
21. What is the difference between a recording and a transcription?

HOW TO GET INFORMATION

How shall we get this information was our next question. Children suggested library books, science books, magazines, interviews, and a trip to the local radio station.

The children became so enthusiastic that we made arrangements with the librarian to go as a group to select books for our project. This experience placed much responsibility on the children for working together, judging books by using their Tables of Content and Index, the use of the Card Catalog, learning where to locate materials in the library, and other growths and developments. Also the children brought books and articles from home.

Children and adults alike were interviewed concerning their favorite radio programs and standards were set up for judg-

ing and listening to good radio programs in the home.

Pupils chose topics on which they wanted to work and committees were formed to begin work. Each committee selected a chairman and when ready presented their information to the other members of the class through reports, round table discussions, and demonstrations of experiments or diagrams.

MECHANICS OF RADIO

Before actually building our radio we had to know something about the mechanics of radio. The discussion of an atom stimulated interest in which the teacher directed detailed planning for the learning of the following concepts: the size of an atom, a molecule, positive and negative discharge, and an electron.

At another period the discussion was centered around the dry cell. Here the concepts developed in the study of the atom were used to build the new concept of the flow of electricity through a conductor.

The third topic was the wave form of water waves. Explanations and the relationship to known things was pointed out.

Ether waves constituted the fourth topic. The problem for discussion was, "If the transmission of waves requires a medium, why do we see light waves from a vacuum light bulb?" Class discussion was stimulated and the teacher mentioned "ether" as a medium. The term was amplified and several kinds of ether waves were mentioned: light waves, heat waves, and radio waves. These terms were developed into concepts through a discussion which brought out the characteristics of ether waves—frequency, wave length, and speed. It was pointed out that our bodies act as "receivers" for heat and light waves. What acted as a receiver for radio waves? Why, your radio of course! The stage was set for our study of radio theory.

The principles of radio constituted the remainder of our discussions. This phase of the study lasted four weeks. In teaching the mechanics of radio, the teacher closely followed the text "Elements of Radio" by Marcus and Horton. This text can be used advantageously when water wave forms are introduced and continued until the theory of the crystal set is completed.

Pupil activity was encouraged at every opportunity. Diagrams and illustrations were made. Students demonstrated electro-magnetism and the movement of dye molecules through water. Undoubtedly the actual building of the two-tube radio was the most interesting activity. Committees were set up for the actual building of the Meissner AC–DC Student Midget kit. Groups of five children worked at one time. These children read and followed the directions carefully and at the end of the period explained to the class what they had accomplished that period. Here there was opportunity for arithmetic experience in that the children had to measure and work with precision.

BROADCASTING IN OUR CLASSROOM

As broadcasting progressed, it became evident that everyone wanted to write and act in a radio play. The children formed writing committees and each group chose the type of presentation they wanted to write. Each group was given three important techniques in radio writing and then proceeded to write their dramatic presentation. All of the presentations were not strictly dramatic, but included a round-table discussion of the unit, a quiz program, a satire called "Radio Recipe," as well as mystery programs. These programs were presented over a portable P.A. system to the class and guests. The microphone was placed in the cloakroom with the speaker in the classroom. This closely resembled an actual broadcast because the actors could be heard but not seen. Every pupil acted in a program.

Many experiences were evidenced as this part of the program developed. All programs were auditioned by the class, according to the standards for good radio programs which the teacher and children set up. Voice and speech were emphasized in

their presentations as well as good habits of listening.

Throughout the unit new words were developed as lessons proceeded. A radio dictionary was kept in which the children looked up words, found their spelling, pronunciations, and meanings and entered them on lined paper for their class dictionary book. This activity proved very stimulating as an aid in actual dictionary practice. The children referred to their dictionary many times for information about words.

The children had practice during the project to evaluate their work. When reports and discussions were made, these were studied by the class as to their value, whether or not the committee presenting the report had done enough research, and how other committees might do better, always summarizing what we actually learned from the work of the committee. This approach kept the class alive and interested, each group trying to be just as responsible as the other groups had been in getting their materials together for presenting.

PARENT INTEREST

Aside from child enthusiasm, parents were interested in our unit. Parents came to hear and see the radio, asking how they might obtain one for their child to build at home. Others were particularly interested in the experiences their children were having in actual broadcasting techniques. One parent who was interested in radar, brought his model radar set to school and discussed it with the children.

This article has been written to give elementary teachers courage to study radio in the grades and in general, present some ideas which a teacher might use with sixth grade or junior high school students.

If we are to fit our curriculum to the needs, interests, and changes in the lives of pupils, we must look beyond the textbooks for those suggestions.

BOOK REVIEWS

MALLINSON, GEORGE GREISEN. *The Use of Films in Elementary Science.* Kalamazoo, Michigan: Graduate Division, Western Michigan College of Education, 1950. 23 p. $0.10.

This bulletin suggests methods by which motion picture films may be used more effectively for teaching elementary science. Included is an annotated list of elementary science films. Films are classified according to subject. Addresses of sources of films are listed.

ZIM, HERBERT S. *Owls.* New York: William Morrow and Company, 1950. Unpaged. $2.00.

This is the seventh title in Dr. Zim's science picture books. Other titles include *Rabbits, Snakes, Elephants, Goldfish, Frogs* and *Toads,* and *Homing Pigeons.* Dr. Zim is recognized as America's best known juvenile science writer.

As in each other title, *Owls* is written in a most readable literary style, with an avoidance of technical terms. Black and white illustrations by Jones Gordon Irving add much to the attractiveness of the book. Much interesting information about the eighteen different kinds of owls living in this country. Owls have very keen sight, remarkable hearing, powerful talons and are one of man's best friends. Records prove that one pair of barn owls killed over 1500 rats and mice in three months to feed themselves and their young.

This is an excellent book for any boy and girl (of any age) to read. Teachers of elementary science will find this excellent for use as a reference or supplementary reader for their pupils.

ZIM, HERBERT S. *Frogs and Toads.* New York: William Morrow and Company, Inc., 1950. Unpaged. $2.00.

This is the sixth in a series of science picture books by Dr. Herbert S. Zim. It is also another of the *Morrow Junior Book* titles. Readers will remember the other books by Dr. Zim as: Rabbits, Snakes, Elephants, Owls, and Homing Pipeons.

Excellent and accurate illustrations by Joy Buba are found on every page. The textual material is interestingly and authentically presented. The type is large and the literary style makes for easy reading even by primary children. Dr. Zim's experience as a classroom teacher has enabled him to write a series of books that pupils and teachers in the elementary grades will find

most interesting and useful as sources of information. *Frogs and Toads* is one of the finest of the entire series. The book will appeal to most elementary and junior high boys and girls. Elementary teachers teaching a unit about frogs and toads will find this about the finest book of its kind that has been published.

Selsam, Millicent E. *Play with Trees.* New York: William Morrow and Company, 1950. 64 p. $2.00.

This is a first book about trees, of about intermediate grade reading difficulty. However the many suggested activities relating to the study of trees could be carried out at different grade levels. Line drawings by James McDonald supplement the text admirably. Simple experiments showing the growth of trees from roots, stems, and seeds are graphically described. The fun of looking for seeds of trees, how they distribute themselves, how to plant and grow the seed, how to collect and preserve leaves, the study of tree shapes, stems and buds, bark, and how to recognize the more common trees are the major features of the book.

This is an excellent elementary science book, useful for both pupil and teacher. The cultivation of an interest, love, and appreciation for trees should be a very important part of teaching science in the elementary grades.

Heiss, Elwood D., Obourn, Ellsworth S., and Hoffman, Charles W. *Modern Science Teaching.* New York: The Macmillan Company, 1950. 462 p. $4.50.

The purpose of this fine book on science teaching is twofold: (1) to serve as a textbook for courses in methods of teaching science and (2) to serve as a source book for teachers of science and science educators and administrators. The book is divided into three sections: section one is devoted to the principles of science teaching; section two considers the problem of science rooms and equipment; and section three is concerned with visual and other sensory aids used in teaching science. Such a text is therefore a must and administrators with building programs will welcome the section on science rooms and equipment. Club sponsors will find the chapter on extracurricular activities in science rich in suggested projects. In line with modern thinking in education there is an excellent treatment of using community resources in teaching science.

Greta Oppe

Nixon, Alfred F. *Teaching Biology for Appreciation.* Boston: Chapman and Grimes, 1950. 147 p. $3.00.

Many objectives have been listed for the teaching of biology in the secondary schools. One has only to examine educational literature—books on methods, courses of study textbooks and articles, to appreciate what an important place objectives have in any discussion of the teaching of biology in the secondary school. Criticism has often been directed against some of the objectives because they were not tangibly measurable. One of the more important objectives of this type has been *appreciation.* To the reviewer this objective has always been one of the most important in science teaching. The lack of objectivity in the measurement of its accomplishment is admitted but that fact does not lessen its importance. Hence the reviewer is in accord with Dr. Nixon's advocacy of teaching biology for appreciation.

In the first three chapters, Dr. Nixon justifies his efforts at teaching for appreciation by carefully documented support from educators, psychologists, and philosophers. The remaining chapters discuss the relation of biology and art, biology and literature, and biology and the social studies. As the author points out biology can be taught so as to bring out the beauty in nature, music, sculpture, paintings and drawings, and even the laboratory.

The book indicates much serious consideration of methods of teaching biology for appreciation. Research into most of the literature of the field relating to this problem is evidenced. An excellent case is made out for making appreciation one of the major purposes of teaching biology. The book is highly recommended for reading by all teachers of biology.

Engle, T. L. *Psychology, Its Principles and Application.* Yonkers, New York: World Book Company, 1950. 628 p. $3.08.

Psychology by T. L. Engle, Department of Psychology, Indiana University, is a thorough revision of his earlier book. It is planned for high schools and junior colleges. Chapters devoted to such high school problems as leadership and popularity, vocational efficiency and marriage will be welcomed by counsellors and home room teachers in the modern high school. After basic information has been presented on the principles of psychology, ways and means of applying psychology to problems are discussed with an abundance of illustrations to link the discussion to the student and his own problems. The chapters on study and reading and how we learn and how we can improve learning techniques are excellent and the checkup on study habits has a valuable test. The unit on problems of personal adjustment is very much worthwhile.

Greta Oppe

McClung, Robert M. *Ruby Throat.* New York: William Morrow and Company, 1950. Unpaged. $2.00.

This is the story of a hummingbird, one of the most interesting of all birds. Although only three and a half inches long and weighing just over two grams (less than a penny), the Ruby Throat is a great fighter and a wonderful flyer. He can fly over fifty miles an hour, fly backward, up or down, as well as forward. In the fall it flies south, across five hundred miles of the Gulf of Mexico, to spend the winter in Central America. In the spring a return trip is made to the apple orchards of northeastern United States.

The author is assistant in the Department of Mammals and Birds at the New York Zoological Park. He writes in simple language suitable for the primary grades. His own illustrations, many in color, add much to the interest and attractiveness of this unusually fine elementary science book.

WEBB, ADDISON. *Song of the Seasons.* New York: William Morrow and Company, 1950. 127 p. $2.50.

This is the story of the year-round doings of animals and plants but mostly animals. It is seasonably told. Each season is different from the others, and the animals act differently in each of them. Springtime is the season for babies. Summer is the time for learning. Autumn is the season for fasting. Winter is the time for rest. The stories of the various animals are told with accuracy, charm, and humor. The author is a member and fellow of the Council of the New York Academy of Sciences.

There are black and white illustrations by Charles L. Ripper. It is an excellent elementary science book for the intermediate grades.

BLEEKER, SONIA. *Indians of the Longhouse.* New York: William Morrow and Company, 1950. 160 p. $2.00.

This is the story of the Iroquois. It tells how they lived before their country was invaded by Europeans. The Iroquois, a federation of six different tribes (Mohawk, Oneida, Onondaga, Cayuga, Seneca and Tuscarora), dominated the territory that is now New York state, but their power was felt over a much greater area. These Indians were farmers as well as fighters. Their crops of corn, squash, and sunflowers were grown in fields hacked out of the dense forest. "People of the longhouse" they called themselves. They lived in villages consisting of long barnlike dwellings made of poles and bark, each one housing ten or more families or fifty to a hundred people. Theirs was a community life. All of the people shared in the work, the men and boys doing the hunting and making tools and weapons. The women planted, cultivated and harvested the crops, took care of the children, and controlled the house and family.

In the early 1600's there were about 15,000 Iroquois living in about twenty villages and today the number is about the same. They live mostly in New York state, nearby Canada and a few in Wisconsin and Oklahoma.

This is a very interesting book for any boy or girl of junior high school age to read. It presents a much truer and fairer picture of these first Americans than has usually been portrayed.

BUCK, MARGARET WARING. *In Woods and Fields.* New York, 150 Fifth Avenue: Abington-Cokesbury Press, 1950. 96 p. $3.00 (Cloth); $1.75 (Paper).

In Woods and Fields is a "book for boys and girls and other beginning naturalists. Every effort has been made to make it as accurate as if it were written and illustrated for scientists. It has been carefully checked by many authorities in the field of natural history." It is rather difficult to classify this book. It is both a reader, and a guide as well as a reference book. The author uses a seasonal approach as she describes what one sees in spring by the streams and in the woods and fields. Summer, autumn and winter seasons are similarly described. Numerous, fascinating illustrations by the author in black and white are found on every page. There are eleven pages with small pictures and descriptions of many birds, butterflies, and moths found in each of the four seasons. At the end of the book is a most useful index and a classified list of books to read.

Teachers of elementary science will find this a most delightful book to use with children both for reading purposes and as a reference. Many teachers will be delighted especially by the seasonal approach, the appealing illustrations, the variety of materials described, and the useful index.

PRESTON, HALL, AND BARR, CATHERINE. *Smokey's Big Discovery.* New York: Oxford University Press, 1950. Unpaged. $1.50.

Smokey was a hungry rabbit who with his friends played havoc with Farmer Brown's carrot field. Black and white illustrations supplement the brief textual material. Story is pre-primer level and the textual material first-grade.

BEELER, NELSON F., AND BRANLEY, FRANKLYN M. *More Experiments in Science.* New York: Thomas Y. Crowell Company, 1950. 176 p. $2.50.

Elementary science teachers will find many interesting and practical experiments that they can use in their classrooms. The directions are simple and understandable. Use of complicated apparatus and materials has been avoided. Many experiments are illustrated. Most of the material can be easily made in the classroom or purchased at the ten cent store.

There are a wide variety of experiments described such as an electric transformer, osmosis, making a turbine, find your location, dancing mothballs, a geyser in the kitchen, energy makes the world go, gardens without soil, messages by telegraph, heating by refrigeration and so on.

Here is a book that will solve the "experiment" problems of many teachers of elementary science. The reviewer recommends it most highly.

WALSH, H. VANDERVOORT. *Your House Begins with You.* New York (120 East 36th St.): George W. Stewart, Publisher, 1950. 248 p. $4.95.

Your House Begins with You is a guide to personal house planning adaptable to the problems of most people who are planning to build. It shows

how to translate family needs into a workable plan. The step-by-step procedures and helpful devices make this an unusually practical and valuable book for all persons planning a house.

There are over 250 drawings, sketches, photographs, and illustrations of ingenious devices. Details of construction are completely worked out. Six ways of building for economy are discussed and examples of such existing houses are shown.

Altogether this is one of the finest books of the numerous books on houses that have appeared in the postwar period. The author taught for many years in the architectural departments of the City College of New York and Columbia University. He has written widely on architectural subjects and has had more than twenty-five years of experience in building houses.

Carleton, Robert H., Williams, Harry H., Buell, Mahlon H., and Schuler, Frederick W. *Physics Activities.* Chicago: J. B. Lippincott Company, 1950. 224 p. $1.20.

This is a workbook in high school physics. Its experiments (45) and exercises (35) cover the units of subject matter commonly accepted as standard for high school physics courses. In addition there is material relating to AC electricity, radar, radio, television, meteorology, jet propulsion and nucleonics. Cross references are made to ten standard high school physics textbooks. Separate unit tests and a Teacher's Key will be furnished upon request.

Davis, Ira C., and Holley, Clifford. *Physics Guide.* Chicago: Lyons and Carnahan, 1950. 316 p.

This is a combination laboratory manual, study guide, review program, and testing program with objective tests furnished under separate cover. There is a complete review unit, illustrated in two colors, furnished at the back of the book.

The material is arranged in twelve main units which are further divided into lesson units on problems. Cross references are made to thirteen standard high school physics textbooks.

There are supplementary activities, reviews, self tests, and extra practice.

Jean, Frank Covert, Harrah, E. Clarence, and Herman, Fred L. *Man and His Physical Universe.* Boston: Ginn and Company, 1949, 643 p. $4.00.

This is the third revision of a book first published in 1934. This revision brings the book up to date in content and corrects certain inadequacies found in earlier editions. Major changes relate to new discoveries in the field of aviation and nuclear physics. Also included are topics relating to radar, sonar, supersonics, two-way radio telephony, plastics, television, and so on.

The authors state that a good textbook should have at least three characteristics: (1) it should be a good source book, (2) it should include material which is related to the instructional problem but is not pertinent to its solution, and (3) it should be interesting to the reader. Interest may be obtained, among other means, by the use of well-chosen illustrations, lucid composition, and good diction; by inclusion of material related to life; and by careful organization.

Based on the criteria of teachability, readable style, apt illustrations, and selection of content, the reviewer considers this the best single college physical science text available.

To those college physical science teachers who consider the science material used in a course as of only relatively minute importance and all textbook use as being old fogy, this text (and any other) would have nil appeal even as a reference.

Hendren, Linville L. *Survey of Physical Science.* Part I. Physics and Astronomy. Athens, Georgia: The University of Georgia Press, 1947. 241 p. $2.75.

This is a revision of a text for a survey course in elementary physics and astronomy which has been given in the University of Georgia since 1932. The text stresses the meaning and value of the scientific method, the history of science, and how physical science has modified men's ways of thinking and living. The material is intended as a basis for a one quarter course which is followed at the University of Georgia by a second quarter survey course of chemistry, geology, and geography.

Altogether this text is somewhat more technical than some survey texts but probably no more technical than some others. Students in this course should have a more fundamental background of physics and astronomy than do students in similar courses taught elsewhere. It may be that the course is overemphasized in this respect. Supplementary explanation in lectures and discussions and the use of demonstrations, films, and other visual aids would seem to be very necessary in this course if students are to obtain the desired understandings and satisfactions which would seem desirable.

Brown, Margaret Wise. *A Pussycat's Christmas.* New York: Thomas Y. Crowell Company, 1949. Unpaged. $1.50.

Here is the story of *A Pussycat's Christmas* told in simple language and in bright pictures by Helen Stone. Reading difficulty is about later first grade.

Ahrens, Maurice R., Bush, Norris F., and Easley, Ray K. *Living Chemistry.* Boston: Ginn and Company, 1949. 551 p. $3.60.

The reviewer thought the first edition of this book an unusually good textbook. This revised edition brings the book completely up to date. There are numerous science teachers who do not like its functional approach, its graphic illustrations, its non-college preparatory emphasis. But that is exactly what the reviewer does approve. A high school chemistry course should have definite interest and appeal to all high school pupils, not only to the small minority expecting to major in chemistry and chemical engineering in

college. And the reviewer would also maintain that a properly trained chemistry teacher can use this book and give the pre-college chemistry major all of the chemistry background necessary to do excellent work in his freshman college chemistry.

New features in this revised edition include new treatment of the structure of matter based on recent discoveries in nuclear fission, exploration of the nuclear energy theory, bibliography of educational films, new references for further reading and so on.

There are 33 units divided into four major headings: fundamentals of chemistry, chemistry of the individual, chemistry of the home, and chemistry of the community. A few of the units are chemistry of clothing, cosmetics, disease, drugs and medicines, fuels and heating, refrigeration and air-conditioning, home decorations, gardening, materials used in modern home construction, and so on.

AUERBACH, BERNARD, AND TEDESCO, A. EDWARD. *Fundamental Activities in Chemistry.* New York: Republic Book Company, Inc., 1947. 342 p. $0.96.

This is a combined workbook and laboratory manual designed for use with any textbook. There are thirteen units consisting of fifty-eight experiments and eighty-five exercises. Cross references are made to a number of high school texts.

Hammond's Comparative World Atlas. New York (305 East 63rd Street): C. S. Hammond and Company, 1949. 48 p. $0.50.

This World Atlas desk edition is a compendium giving precise geographical information. The maps are based on the latest reliable surveys supplemented by official statistical data. There are 33 pages of colored maps—political, physical, fauna, and flora. Photographs, charts, and tables present much valuable information. The Atlas should be of interest to all laymen and teachers, and especially to geography and science teachers.

SMITH, ELLA THEA. *Workbook to Accompany Exploring Biology.* New York: Harcourt, Brace, and Company, 1949. 154 p.

This is a loose-leaf biology work-book to accompany the author's *Exploring Biology* reviewed in a previous issue of *Science Education.* Work sheets may be handed in separately. Most of the exercises are of the fill-in blank type. Review exercises and questions are included for each unit.

WHEAT, FRANK M., AND FITZPATRICK, ELIZABETH T. *Biology.* New York: American Book Company, 1949. 571 p. $3.40.

This biology test is planned for use in the tenth grade in high school. It was written by a team of familiar and successful authors experienced in high school biology. In preparing the text, the authors have kept in mind two objectives: (1) to create interest and enthusiasm for the science of life and (2) to stimulate some students to go on with biology or allied fields of science. The subject matter has been organized into nine units composed of problems, challenging questions, exercises and summaries to substantiate the subject matter. The organization of the book is so satisfying in its simplicity and orderliness, and the laboratory exercises written into the body of the book are varied and stimulating. The "Interesting things to do" really are interesting. Throughout the text the student is made aware of the age of science and his responsibility in such a world and also his opportunity. It is a text that a student can use and find the answers.

GRETA OPPE

MILLER, FRED R. *Progressive Problems in Physics.* Boston: D. C. Heath and Company, 1949. 237 p. $2.00.

The sales slip read: "a favorite for 40 years." The preface indicates no other title will describe the scope of this small book over this period of years. In this 6th edition are copies of the latest published College Entrance Examinations and New York Regents Examination. *Progressive Problems in Physics* is a helpful book for busy physics teachers.

GRETA OPPE

The Explorer Naturalist, Oct.–Nov., Vol. 1 (2). Amateur Naturalists Association, Los Altos, Cal., 1949. 29 p. $0.25.

The Explorer Naturalist is the official journal of the A. N. A., distributed on a non-profit basis and consisting of loose-leaf pages stapled together and devoted to the exploration of the out-of-doors and the conservation of our natural resources. It is an interesting little journal and would be quite helpful in elementary science classes with its helpful suggestions for studying nature. The bird study by silhouette identification is most interesting.

GRETA OPPE

SAVAGE, JAY M. *Lizards, Snakes and Turtles of the Western U. S. and Canada.* Los Altos, California: Naturegraph Company, 1949. 32 p. $0.50.

This is an excellent Naturegraph pocket key. An excellent reference list accompanies the key.

GRETA OPPE

HILTON, ERNEST. *Rural School Management.* New York: American Book Company, 1949. 278 p.

It was estimated that in 1944 there were 108,000 one-teacher rural schools and 25,000 two-teacher schools in the United States. Together they enrolled some three and a half million children and employed one-eighth of the nation's teachers. This despite the great amount of consolidation and transportation in the last two decades.

Rural life has advantages and disadvantages which are discussed by the author. Many problems of teaching in rural areas are similar to the problems of teaching in urban areas. Other problems are unique for rural teachers. The

author discusses these in a practical sort of way: understanding and guiding child behavior, evaluating child growth and development, rural teacher's records and reports, health and safety in the rural school, school plant and school housekeeping, instructional supplies, materials and equipment, and the future of the rural school.

DAVIS, FRANK G., AND NORRIS, PEARL S. *Guidance Handbook for Teachers.* New York: McGraw-Hill Book Company, 1949. 344 p. $3.50.

Guidance work is becoming an increasingly important aspect of the teaching job. For many years it has been recognized that one of the important obligations of the public school system is an effective guidance program. Such a program begins with the first grade and extends on into college. Some schools and colleges are doing a fairly adequate job, but by and large a majority of schools would receive a failing mark in this area.

There have been some wide and sharp differences of opinion as to how this guidance program can be carried out most effectively. Many have advocated specially trained individuals whose major school function is that of serving as guidance director. Seemingly most educational guidance leaders now believe that the most effective help can be rendered by the regular classroom teacher. This seems to be the philosophy of the authors of *Guidance Handbook for Teachers.* Written from a psychological approach the book considers the problems of the individual teacher, illustrated by numerous examples. Mental and physical health are considered, and such subjects as keeping a pupil up to his ability, a new type of report to parents, cumulative records, personality and other rating charts, keeping of anecodtal records, and so on.

This would seem to be an unusually fine book for all teachers, especially those having inadequate backgrounds in educational guidance but who need and desire some practical help while on the job.

Symposium. Proceedings of the Eighty-Seventh Annual Meeting of the National Education Association held at Boston, Massachusetts July 3–8, 1949. Washington, D. C.: National Education Association, 1949. 419 p.

This is a summary of addresses before the Representative Assembly, minutes of business meetings, annual reports, reports of departments, association records, and information.

HURD, ARCHER W. *Problems of Collegiate Success or Failure with Particular Reference to Professional Schools of Medicine.* Richmond, Virginia: Bureau of Educational Research and Service, 1949. 124 p.

Despite great care in selection, a rather high proportion of medical students annually fail of promotion. Why? It was Dr. Hurd's purpose to ascertain some of the reasons for these failures as well as reasons as to why other individuals were successful. Abstracts of studies by other investigators are reported in the appendix. In the Medical College of the University of Virginia about 22 per cent of those admitted are eliminated for one reason or another. Dr. Hurd made a study of the reasons for these eliminations as well as reasons for the success of those completing their work.

Tests, case studies, and interviews were used by the investigator. One test was a reading ability test. Dr. Hurd found that those who failed, on the average, were poor readers of medical literature. On the other hand there were some poor readers among those making satisfactory grade ratings. The investigator found that present reading tests at the college level seem to lack reliability and validity and hence have small value as a predictor of success. It also was found that aptitude tests had some use in predicting later college success, especially for those successful. It was found that the admission of students because of the occupations of their fathers was of little predictive value. During the freshman year there were more failures from those coming from non-urban areas. Students from northern states had fewer failures than students from southern states. Success or failure seems to depend upon certain personality factors. There seems to be no significant difference between veterans and non-veterans in intelligence or achievement; nor between married or unmarried students. Intelligence and adjustment cannot be neglected. Pleasant personality characteristics should not obscure real student achievement and intelligence in thinking and acting. Personal opinions are more unreliable than objective examinations. Interviews should be as objective as possible.

Altogether this study is an important contribution not only to those interested in medicine but for all other professions. Similar studies relating to teaching would be of great significance.

LITTLE, HARRY A. *Handbook for Supervisors of Student Teaching.* Milledgeville, Georgia: Harry A. Little, Georgia State College for Women, 1947. 125 p.

Student teaching is an important part of all good teacher education programs. In all or practically all states, student teaching is a prerequisite for the issuance of a teaching certificate. This handbook should prove useful to most beginning supervisors of student teachers. Experienced supervisors will find it a useful reference book.

COOK, EDGAR M., AND CATES, JOHN H. *Observation and Study Guide for Student Teachers.* St. Louis: The C. V. Mosby Company, 1947. 159 p. $3.50.

This is a loose-leaf guide for student teachers and may be used in either elementary or secondary schools. The last section contains a number of observation sheets. There are thirty units

covering various phases of teaching methods such as questioning, lesson planning, the assignment, the appreciation lesson, grading and marking, and so on. This seems to be a very good manual for those courses in which the student teachers use such a manual.

LANDRY, HERBERT A. *A Teacher Personnel Program for the Schools of the State of New York.* Mount Vernon, New York: New York State School Boards Association, Inc., 1947. 124 p.

This is a report prepared by Dr. Landry of the Bureau of Reference, Research and Statistics of the New York City Schools for the Committee on Teaching Efficiency of the New York State School Boards Association.

The report considers: (1) Teacher Personnel Programs, (2) The Selection of Teachers, (3) The Induction of Teachers, (4) Promoting Physical and Mental Health, (5) Promoting Professional Growth, (6) Evaluation of Teachers, (7) Organization and Administration of Teacher Personnel Programs, and (8) Evaluation of a Personnel Program.

This comprehensive report should be of great value in every state, to all teacher training institutions, and to supervisory and administrative staffs in each school system.

SYMPOSIUM. Teacher Personnel Research, Monograph Number 3. Madison, Wisconsin: Dembar Publications, Inc., 1947. 132 p.

This monograph is a reprint of articles appearing in the December 1946 and September 1947 issues of the *Journal of Experimental Education.* There are four articles as follows: *Appraising Teacher Personnel* by David G. Ryans; *A Comparative Study of Students Preparing for Five Selected Professions Including Teaching* by Lawrence Philip Blum; *A Study of the Professional Curriculum Requirements for the Preparation of High School Teachers in the United States* by Kenneth Ralph Doane; and *Relationship Between Teacher Certification and Education in Wisconsin: A Study of Their Effects on Beginning Teachers* by Lois Gadd Nemec.

This is an unusually fine and significant monograph. The article by Ryans is a report of the activities of the American Council on Education's committee on Teacher Examinations and an analysis of the results of the eighth annual teacher examination program. The titles of the other three articles are self-explanatory.

BROADY, KNUTE O., BROADY, LOIS PEDERSEN, AND WESTOVER, ADA STIDWORTHY. *Orientation and Guidance for High School Pupils.* Lincoln, Nebraska: University of Nebraska Press, 1947. 320 p.

Orientation and Guidance for High School Pupils was written for boys and girls registered for the first year of their work in a three- or four-year senior high school. The book may be made the basis for either a full-year or a semester course. It could well serve as a text also in a "common learning" class. There are eight units as follows: Making Yourself an Effective Worker, The Good Citizen In and Out of School, The Good Citizen and Safety, Schools of the Past and the Present, Opportunities in Your Own Community, Our World of Work (occupations), Finding Yourself, and You Choose a Vocation.

A Teacher's Manual is available as well as tests for each unit.

This book should serve as a most useful and practical guide in "common learnings" or similar courses in high school. It seems especially useful for the smaller high schools and especially those in agricultural areas. Undoubtedly this book fills a very great need. The authors are practical school people who know the problems of small high schools.

SYMPOSIUM. *Guide to the Study of the Curriculum in the Secondary Schools of Illinois.* Springfield, Illinois: Superintendent of Public Instruction, 1948. 42 p.

This bulletin was prepared by the Committee on Reorientation, a sub-committee of the Curriculum Committee of the Illinois Secondary School Principals' Association. The bulletin presents suggestions regarding ways and means of effecting curriculum improvements in the secondary schools of Illinois. Major phases of the bulletin are: Where We Have Been, Where We are Now, Looking Ahead, Making Plans, Getting Started, Going Forward, and Checking Progress.

School people everywhere would profit much from a serious study of this timely and thought-provoking bulletin. It offers many sound, practical suggestions for making the schools better instruments for meeting the basic needs of high school youth. What the committee has done is only the preliminary step. The greater and longer task is putting the suggestions into actual operation in the secondary schools of Illinois. But this bulletin shows that some hard thinking has been done about making a real reorientation in the program of Illinois secondary schools.

CHANDLER, ANNA CURTIS, AND CYPHER, IRENE F. *Audio-Visual Techniques.* New York: Noble and Noble, Publishers, 1948. 252 p. $3.50.

Audio-Visual Techniques for enrichment of the curriculum has been prepared as a class text for the classroom teacher, teacher-in-training, or college student in search of ideas and suggestions for developing an audio-visual program for enriching the daily classroom curriculum. This book is crammed full of practical "what-to-do" chapters, directions, suggestions, and techniques that should prove invaluable to every classroom teacher. An important feature is the "where-to-find-it" section listing all of the important sources.

Visual aids should have an important part in classroom teaching. Properly and effectively used, they offer one of the best means for increasing the effectiveness of the teaching procedure. In all too many classrooms they are used most ineffectively and have become mere crutches and time-killers for the lazy and ignorant teacher.

McAllister, Charles E. *Inside the Campus.* New York: Fleming H. Revell Company, 1948. 247 p. $3.00.

This is a report of a year's study of eighty-nine colleges and universities. It is divided into three sections: (1) The contributions of the state colleges and universities in the fields of industrial relations, national welfare and economy, and the need for revising college entrance requirements; (2) Relations between college presidents and boards of regents, faculty, students, and alumni; tuition rates and salaries; the use of audio-visual aids in higher education; and the relations of the universities to Congress; (3) A series of tables worked out in great detail, giving the findings on each institution surveyed. Among interesting finds was that communism is less a threat to student morale and character than is cheating on exams! Although the practice of cheating seems to be rather general, it is indulged in by only a minority of students and the great majority of the student body resents cheating.

Most of the information given in detail in the twenty-one tables is given specifically for each college and university. This is true of every table except the one relating to salaries. Evidently college administrators have a guilty conscience here!

Kirkendall, Lester A., Kuenzli, Irvin R., and Reeves, Floyd W. *Goals for American Education.* Chicago, 28 E. Jackson Boulevard: American Federation of Teachers, 1948. 130 p.

Goals for American Education are stated as the following things the schools must do: (1) Help close the gap between scientific advance and social retardation, (2) Prepare individuals to create and live effectively in a cooperative, interdependent society, (3) Extend the interest and concern of people in international cooperation and the maintenance of a just and durable peace, (4) Help in securing acceptance of the ideals of democracy in social, economic, and political arrangements, (5) Develop values that will serve to guide the individual toward high standards of moral conduct and ethical living, (6) Provide for the development of creative abilities and afford avenues for expression in constructive activities, and (7) Insure the mastery of the common integrating knowledge and skill necessary to effective daily living. There are chapters on The American School System, Major Deficiencies in American Education, A Program for American Education, and Can We Afford This Program? Specific suggestions are made regarding the deficiencies and the program for American education. Altogether this is a most timely and challenging study of the goals of American education.

Liber, Benzion. *Psychiatry for the Millions.* New York: Frederick Fell, Inc., Publishers, 1948. 307 p. $2.95.

The American public, especially in the war and postwar period, has been made psychiatry conscious. By and large, psychiatry now seems to be fairly well established, although it is still looked upon by numerous individuals with a great deal of skepticism.

Psychiatry for the Millions explains what psychiatry is and what it attempts to do. The author believes psychiatry offers real help for many people who are in the "twilight zone" between mental health and mental disease. The war and postwar period have accentuated the problem of mental disease. The number of practicing psychiatrists has greatly increased in the postwar period. Undoubtedly here is an important area that is greatly in need of medical service and an area in which much good can be done. It is also an area in which there is great opportunity for much unmitigated fraud and quack practices. Both the public and the trained psychiatrists need to see that only well trained persons are allowed to practice in this area. It is so easy and often so profitable for the shyster to practice on the gullible public.

The author uses many case histories to illustrate the applications of psychiatry in the various types of mental illness. The book is interesting reading and gives a clear understanding of the operative realm of psychiatry.

Kandel, I. L. *The Impact of the War Upon American Education.* Chapel Hill, North Carolina: The University of North Carolina Press, 1949. 285 p. $4.25.

Many school men during the war were confident that education would be revolutionized by the war especially in methods and techniques, and to a less degree in curriculum content. Did this revolution materialize or is it now materializing? Many felt that war showed up many inadequacies and deficiencies that would need immediate attention after the war. Other individuals felt that war conclusively proved that the American school system, as compared to some others, had not done and was not now doing so badly. Dr. Kandel sets about in this book to determine exactly what impact the war did have upon the American school system.

At least one thing was evident during the war and is still being felt. Many individuals left the teaching profession for better paying industrial jobs. Few of these teachers have returned to the profession and emergency certificates and crowded classrooms are now all too evident. Seemingly the American public has not yet realized the key position of the teacher in giving reality to the ideal of equality of educational opportunity for all.

The war courses in secondary schools have now largely disappeared. Elementary schools felt the war crisis primarily because of loss of teachers and the necessity of granting emergency certificates. Courses were only slightly affected.

Higher education was much more affected by the war than other divisions of the public school system. Many faculty members went into war work and the services and civilian student enrollment sharply declined. However many colleges carried on army and navy specialized training programs. Here the colleges made a great record.

In the postwar period veterans have set the pace in American colleges. Contrary to expectations veterans have set the pace academically for the non-veteran.

Seemingly post-war college training has been and is undergoing more changes than has pre-college training. Veterans have demanded more technical training and there is a definite trend toward general education, not only for arts students but also for the engineer, the pre-law, the medic. This general education demand resulted in a swing away from the system of electives. Three areas are being emphasized in general education—the natural sciences, social sciences, and the humanities.

Dr. Kandel has presented a penetrating analysis of the impacts of the war upon American education. Dr. Kandel is a well known educator, author, and editor. He is now Professor Emeritus at Teachers College, Columbia University. Many will remember the author's *History of Secondary Education and Comparative Education.* He is Editor of *School and Society* and has served as Editor of the *Educational Yearbook,* and Universities Quarterly.

KEINER, S. S. *Doctor Don't Let Me Die.* Boston: Meador Publishing Company, 1947. 486 p. $3.50.

This is the story of the life of a doctor. While presented as being entirely fictitious as to characters and incidents, one rather gathers that the events described did occur and that the characters did live under another name. It is a challenging, interesting book from beginning to end.

Dr. Henry E. Sigerest, well known writer and William H. Welch Professor of the History of Medicine and Director of the Institute of the History of Medicine at Johns Hopkins University, says in the Introduction "This was not what I expected, was not the traditional physician's autobiography, was not a biography at all. It was a passionate outcry, a hymn on life, a wild rhapsody written in a breath-taking style. . . . I read for hours until dawn. . . .

"The author is a practitioner like thousands of others. . . . We live in an economy of waste and scarcity and one of the most stupid wastes is the inactivity forced upon well-trained young physicians eager to serve, while at the same time thousands of sick people cannot afford a doctor. . . . Poverty with all of its dire consequences, vice, corruption, prostitution and disease, is the *leitmotif* of the book. . . . Many scenes are so forceful that readers will never forget them. . . . It is a broad picture of contemporary life in its struggle with the forces of death, seen by a sensitive physician who does not take matters for granted but reflects about them and rebels. . . . It is a great book." And the reviewer agrees most wholeheartedly with Dr. Sigerest, that this is a truly great book, one of the finest of its kind that has ever been written.

It is the story of the life of a doctor, his days of college training, the internship, and the weary hours waiting for patients that never came—so many because they could not afford to, but later on the patients did come but in both circumstances the same soul-rending cry of "Doctor, don't let me die."

Part IV called "The Human Fantasy" is an outstanding bit of modern literature—a philosophy that is of so great a significance that it deserves to be long remembered.

MITSCHERLICH, ALEXANDER, AND MIELKE, FRED. *Doctors of Infamy.* New York: Henry Schuman, Inc., 1949. 172 p. $3.00.

This is the uncensored, unglossed, and fully documented story of the Nazi medical crimes—the torture and killing of human beings, under the guise of medical experimentation. Learned doctors, so-called men of science committed crimes of sadism, of sex, and infanticide.

The material in this book was compiled by two Germans, one a well-known doctor, from direct testimony and documentation presented at the Nurenberg war crime trials. It is presented coldly, factually with little editing.

The Nazi medical atrocities seem incredible. Hitler and his gang were bereft of morals and of a respect for human rights. They operated on the immoral principle that "necessity knows no law." The Germans called these atrocities "experiments in the interest of science." They were murders. Of the thousands of "subjects," only a few remained alive to testify. Although the crimes were committed by a relatively few (two hundred or so) physicians, most other physicians and Germans knew about the practices, yet not a single one offered a public protest. Were the criminal medical crimes carried out in Germany of any real scientific value? The answer is an emphatic "none whatsoever." The general categories of Nazi medical experimentation were sterilization; exposure to low pressure, cold, and sea water; injection of infectious virus into open wounds; mutilation and grafting of limbs; development and application of efficient methods of large-scale extermination and genocide.

This book does not treat as such the mass exterminations at the various concentration camps at Dachau, Buchenwald, Auschwitz, and so on. In the trial known as "The Case Against the Nazi Physicians," lasting for 139 days and completed on August 20, 1947, fifteen of the twenty-three defendants were found guilty. Seven were hanged and five were given life sentences. The only woman among the defendants was given a twenty-year sentence.

RANTOUL, ROBERT. *Shoot That Needle Straight.* Boston: Bruce Humphries, 1947. 220 p. $2.75.

This is the humorous, human story of a young man's adventures in everyday life as a diabetic Written around the actual experiences of one who has had diabetes for eighteen years, the book has been checked for accuracy by eminent doctors.

It dispels many prevalent misconceptions and makes for a better understanding of the problems

of a diabetic. It should serve to cheer, comfort, and encourage the many persons who now have diabetes. The proper mental attitude is emphasized. Diabetics will especially enjoy the book with its humorous, practical slant, but other persons will also enjoy and profit from its reading.

Pemberton, Lois. *The Stork Didn't Bring You.* New York: Hermitage Press, Inc., 1948. 213 p. $2.75.

The Stork Didn't Bring You presents the facts of life for teenagers in a language and style that can be readily understood. This is a straight-forward, intelligent guide for teenagers in their own vernacular. It is also a book for parents, and teachers. It should serve excellently as a book for classes in sex education or for "common learnings" courses. No issues are avoided and yet all questions are handled sanely with tact and understanding. Many of the pressing problems of youth are frankly, practically discussed, including the approach to kissing, petting, and morals. The problem of suitable reading material for sex education has long been a perplexing one. Altogether this book is about the best that reviewer has ever read.

Bibby, Cyril. *How Life Is Handed On.* New York: Emerson Books, Inc., 1947. 159 p. $2.00.

This is a book for parents and especially younger adolescents. The information is based on modern scientific knowledge and is written especially for adolescents. The author gives a clear and simple description of the whole broad process by which life is handed on and maintained. Animals, plants, and humans are used as illustrations. Facts are handled wisely and tactfully. The development of right attitudes is stressed. It would serve excellently as reading material in courses in sex education and in "common learnings" courses. The author is editor of *Health Education Journal* and author of *Sex Education: A Guide for Parents, Teachers, and Youth Leaders.*

Swartz, Harry. *Allergy.* New Brunswick, New Jersey: Rutgers University Press, 1949. 210 p. $2.75.

It is believed that one out of every two persons suffers from some allergy. Allergy may result from any aspect of the environment including heat, light, cold, fear, insecurity. Many allergies have an entirely emotional basis such as fears, anxiety, and other maladjustments. In the rooms of the home are innumerable sources of allergy. Even another person may be the source of the allergy!

Dr. Swartz describes those allergies and tells what to do about them. The author traces the history of allergy from the earliest scientific explanation to the present day concept that allergic symptoms are the result of the body's overaction in its normal attempt to deal with its environment. The author describes principles involved in specific therapy; classifies drugs and mechanical aids; and gives case histories.

Tobey, James A. *Your Diet for Longer Life.* New York: Wilfred Funk, Inc. 280 p. $3.50.

All normal men are interested in living as long as possible. They have always been as is attested by the researches of the alchemists and the explorations of Ponce de Leon. The span of human life has been greatly increased during the present century. The normal life expectancy in the United States is now sixty-seven years. Specific food factors have been greatly responsible for this improvement in longevity and in general health.

Sound, practical advice is presented in this book on diet—diet for losing weight, for gaining weight, for maintaining ideal weight. Suggestive menus are included, tables listing calories and vitamins found in various foods, foods that feed your blood, nutrition for nerves and fatigue, building better teeth. Food fads and follies are discussed: vegetarian fad, the meat fad, the refined food fad, the "health" food fad, the roughage fad, the fasting fad, and so on.

Dr. Tobey is well known for his radio programs over WOR and for his numerous books including *Cancer: What Everyone Should Know About it, Riders of the Plagues, The Quest for Health,* and so on.

Symposium. *Never Too Old.* Newburgh, New York, 94 Broadway: Thomas C. Desmond, 1949. 216 p. Free.

This is a report of the New York State Joint Legislative Committee on Problems of the Aging. Numerous individuals have contributed to this symposium on the various phases of aging. Among the problems discussed: employment problems, attitude of industry, attitude of labor, physiological capacities of elderly workers, health problems, recreation problems, pension plans, and retirement problems.

This report is of great significance not only to every other state legislature but to every person in the United States. Numerous tables present much interesting statistical information.

Crumbine, Samuel J. *Frontier Doctor.* Philadelphia: Dorrance and Company, 1948. 284 p. $3.00.

This is the autobiography of one of America's best known health crusaders. Born in a log cabin in Venango County, Pennsylvania, in 1862, and the son of a blacksmith who died in the Civil War, Dr. Crumbine received his medical education in the Cincinnati College of Medicine and Surgery. He went to Kansas when that state was really the wild and wooly west and a true frontier. His "Swat the Fly," anti-public drinking cup and roller towel campaigns won him state and even national acclaim as a public health crusader. He was for nineteen years Secretary of the Kansas State Board of Health. He also served as Dean of the School of Medicine of the University of Kansas. Following 1923 he served with the American Child Health Association.

Frontier Doctor is a delightful book to read and would serve excellently as supplementary reading material for career or educational guidance courses.

FEATHERSTONHAUGH, DUANE. *Nature for All.* New York: Barnes and Noble, Inc., 1948. 136 p. $0.75.

Nature for All is one of the *Everyday Handbook Series.* It is for the general reader, giving him interesting and useful information about a great variety of plants and animals. Chapters are devoted to trees, flowers and other plants, birds, mammals, reptiles and amphibians, fishes, and invertebrates.

High school biology students, elementary science, general science, and biology teachers will find this a useful reference.

SLOANE, ERIC. *Clouds, Air, and Wind.* New York (23 East 26th Street) 10: The Devin-Adair Company. 75 p. $3.00.

Clouds, Air and Wind is not only a simplified book on meteorology but a work of art. It is an excellent book for the elementary science, general science teacher or layman who wants to know something about meteorology. During the war the book was in official use in the U. S. Army Air Corps and in Pre-flight training schools. Through clever and pertinent pictorial charts and his own paintings, the author explains the origin and meanings of clouds, their importance in aviation and the necessity of a thorough knowledge of cloud formation as a first step in the study of meteorology.

LACEY, JOY MUCHMORE. *Living in Indiana.* Chicago: Wheeler Publishing Company, 1946. 123 p.

Living in Indiana is a charming and interestingly written story of the more general events and movements in the geographical and historical development of Indiana. Elementary teachers and pupils will find the book especially useful for information on the Hoosier State. Pupils of the upper intermediate or junior high school level can readily read the printed material. It should be a required reading of every Indiana child at this age level.

LANSING, ELIZABETH HUBBARD. *Rider on the Mountains.* New York: Thomas Y. Crowell Company, 1949. 278 p. $2.50.

This is a very interesting book. While the characters are fictional, the incidents and description are based on the author's experiences. It is a story of the real problem of human conservation among the peoples of eastern Kentucky. The book would serve as interesting supplementary reading for courses in "common learnings" or vocational guidance.

WILLS, ROYAL BARRY. *Planning Your Home Wisely.* New York: Franklin Watts, Inc. 94 p.

Planning Your Home Wisely has 243 drawings including 20 complete houses designed for modern living. Drawings and comments include living rooms, studies, cellars, basements, attics, garages, porches, bedrooms, living rooms, laundries, kitchens, children's rooms, closets, places to put things, and so on. A number of drawings have been prize winners in architecture contests. The author is one of America's foremost architects of small houses.

MCNAMARA, JOHN E. *How to Get the Most House for Your Money.* Chicago: American Technical Society, 1947. 182 p.

This book tells the prospective home builder how to save on purchase of a lot, recognize plans that are lowest in construction cost, to utilize new ways of using architectural services, and how to deal with the builder and supervisor of construction.

All phases of planning each separate part of the house as well as the complete house itself are given in description, drawings, and photographs. There are over 100 sets of plans. Prospective builders may obtain a set of plans at rather nominal cost.

The author is head of Certified Homes Bureau, editor of *Homes For Tomorrow,* and former associate editor of *American Builder.*

CARPENTER, ALLAN, GUESS, NORMAN, AND EDITORS OF POPULAR MECHANICS. *Primer for Home Builders.* Chicago: Windsor Press, 1947. 171 p. $2.50.

Numerous authorities, men with a background of practical experience have contributed to this volume. The following phases are discussed: Planning: (1) Don't Be Afraid to Build; (2) Meet Your Neighborhood; (3) Plan from the Inside Out; (4) How Are We Going to Pay For It? Building: (1) Should We Have an Architect? (2) What Does a Contractor Do? (3) You Have Legal Rights: Protect Them; (4) Materials Make the Home; (5) New Things for New Homes; On Buying Old Houses: (1) Look at the Inside, (2) Look at the Outside. Much useful material is found in the appendix: Mortgages, agreements, specifications, contracts, and so on.

Persons planning to buy or build a home will find many practical suggestions that may save them much disappointment and some money.

KAUFMAN, GERALD LYNTON. *Homeseekers' Handbook.* New York: George W. Stewart, Publisher, Inc., 1947. 160 p.

This is a guide book for the prospective home-owner, whether buying or building. Pros and cons of many problems are discussed: whether to rent, buy, or alter; the different types of mortgages; importance of planning; selecting the site; prefabrication; materials; mechanical equipment; contractors and contracts; architect; interior decorator; landscaping; insurance. It is an interesting, readable, practical book for even those already owning a home. The author has been a specialist in residential architecture for the past twenty-five years and is the author of *The*

American Home Book of Building, The Road to a Home, and numerous articles on home building.

DALZELL, J. RALPH, AND TOWNSEND, GILBERT. *Masonry Simplified.* Volume I, Tools, Materials, Practice; Volume II, Practical Construction. Chicago: American Technical Society, 1948. 367 p. 405 p.

Fundamentals of practical masonry are presented in these two books. The authors are authorities in this field. The volumes are most readable, supplemented by numerous easily understood illustrations. Anyone contemplating construction such as buildings, foundations, side-walks will find the volumes most useful, possibly saving them much money and many disappointments.

CRAWFORD, JOHN E., AND WOODWARD, LUTHER E. *Better Ways of Growing Up.* Philadelphia: The Muhlenberg Press, 1948. 270 p. $3.00.

This is a fascinating book on the psychology of adolescence. The authors attempt to speak directly to boys and girls, using plain talk, a simple approach, and a series of self-analysis tests. Boys and girls are concerned with real problems of growing up. Boys and girls are sensitive, impressionable, and zealous for the experiences of the full life.

This book enables teenagers to better know, understand, and accept themselves; how to improve themselves, break down their superstitions, and false ideas; how to reduce personal and social conflicts, and develop more wholesome social attitudes and skills.

Better Ways of Growing Up would be an excellent book to use as supplementary material in courses in secondary psychology or "common learnings" course; for adolescent boys and girls to read on their own, for parents, for guidance teachers; even all teachers!

WIGGAM, ALBERT EDWARD. *New Techniques of Happiness.* New York: Wilfred Funk, Inc., 1948. 352 p. $3.75.

Dr. Albert Edward Wiggam, born on a farm in Southern Indiana, has long been known as a distinguished science reporter. Many readers will recall his earlier *The New Decalogue of Science, The Fruit of the Family Tree, The Marks of an Educated Man, Exploring Your Mind,* and *The Next Age of Man.* It is estimated that his newspaper feature *Let's Explore Your Mind* is read by twenty million readers.

New Techniques of Happiness utilizes the findings of leading psychologists and sociologists. The report is based on the extensive reports of the many investigators and thinkers whose original works form the basis for this volume. It is said that when the book was finished that Dr. Wiggam gave 2000 volumes of these books to his old college, Hanover, in Indiana, for research among the students.

Case studies are included, also analysis tests and charts. Practical suggestions are given so that individuals can attain greater self-satisfaction. Among the twenty-nine chapters are: How to Manage Your Emotions, Three Basic Techniques to Solve Your Problems, Happy and Unhappy People Have the Same Problems, How to Overcome Self-consciousness, How to Conquer Fear and Worry, How to Get Along with People, You Can Master Your Environment, You're Never Too Old to Learn, Happiness Depends on Appreciation, and Science and Religious Happiness.

FISHBEIN, MORRIS, AND BURGESS, ERNEST W. (Editors). *Successful Marriage.* Garden City, New York: Doubleday and Company, Inc., 1948. 547 p. $6.00.

Successful Marriage is a readable, thoroughly modern and authoritative discussion on marriage. Thousands of questions are answered on the basis of long counseling experience by outstanding doctors and advisers on marital relations. Thirty-eight specialists have contributed to this subject. They include such specialists as Ernest W. Burgess, Evelyn M. Duvall, Robert L. Dickinson, Lewis M. Terman, Thurman B. Rice, Warren P. Spencer, Abraham Stone, Katherine Whiteside Taylor, James H. S. Bossard, and many others.

WEISMAN, ABNER I. *The Engaged Couple Has a Right to Know.* New York: Renbayle House, 1948. 256 p. $3.00.

The author is an eminent physician who utilizes his practical knowledge in discussing the problems of marriage. All sorts of problems are discussed. Their frank facing and discussion would eliminate many marriage failures. A number of outstanding medical men praise the presentation.

BENGE, JEAN AND EUGENE. *Win Your Man and Keep Him.* Chicago: Windsor Press, 1948. 183 p. $3.00.

This would be an unusually important book if through reading it women could do a much better job along the line indicated than is presently being done. A great many of the social problems in the American scene would be solved if the divorce rate could be greatly reduced. The reduction in the number of broken homes and families would be of important economic and social consequence. The book offers many practical suggestions as to social behavior, dress, judging other persons, and so on, based on social and psychological studies. It would serve excellently as supplementary reading for the courses on marriage now offered in many colleges. It might be useful in high school "common learnings" courses. There are a number of excellent self-analysis charts and tests.

GERTH, JOSEPHINE H. *Highways to Jobs for Women.* New York: The Woman's Press, 1948. 132 p. $3.00.

Highways to Jobs for Women is designed to help college women in their over-all preparation for and choice of a specific position. Far too

often many college girls seem to be just drifting along. "I don't know what to take this semester because I don't even know what I want to be! What can a college woman do except to get married, teach, or be a social worker?" This book is written for these girls. The full scope of occupations from typing positions for the college girl to highly specialized professional careers is covered. The work experience and educational requirements for particular jobs are given. The liberal arts curriculum is analyzed in relation to these occupations and the personality characteristics which contribute to success in various jobs are defined, frankly and directly. Self-analysis techniques are included.

It is an excellent book for all who assist in guidance work at the college level, and even high school level.

DUNN, H. ALAN. *Laughing His Way to a Million.* Los Angeles 41, Box A. H.: Continental Publishers, 1948. 335 p. $3.50.

In *Laughing His Way to a Million* Obie Hope turns over to the reader a true story of success, inspiration, and wise example. Within thirty years Obie, by honorable dealings, a happy smile, and faith jumped his income from 32 cents a day to over $400,000 a year. The son of a poor, honest woodchopper in the Arkansas back country, Obie became a successful salesman and business leader. This is a real success story. The true identity of Obie Hope is revealed in the last chapter, but all of the earlier related incidents are declared to be true.

MILES, LESTER F. *It Pays To Be Lazy.* New York: Wilfred Funk, Inc., 1948. 242 p. $2.50.

There are two common types of laziness. One kind produces absolutely nothing—is just plain shiftlessness. The right kind acts in a productive way and spurs one to success with the least amount of effort. Success comes to some people through breaks, personal favor, or friendships. The author presents an easy way to gain business and social success.

The author says it pays to be lazy, that we can be happier, more successful and live longer! Hurrying has led to an early death for many persons seemingly in perfect health. The author tells how it is easy to develop self-confidence, to get along with other people, to determine if you have the right job now, to get a better job at higher pay, to plan to get what you want, to have successful retirement.

KEITH, HAROLD. *Shotgun Shaw.* New York: Thomas Y. Crowell Company, 1949. 163 p. $2.00.

This is a baseball story that will delight most boys. While the characters are fictional, the information is by an authority in the field. It is not a bad book for the boy in the English class having a difficult time appreciating the classics. It could be used effectively as a supplementary book in the "common learnings" course.

JACKSON, C. PAUL. *Rose Bowl All-American.* New York: Thomas Y. Crowell Company, 1949. 245 p. $2.50.

The characters are fictional but the descriptive football is authentic. An excellent book for boys with helpful applied psychology. It would serve excellently for supplementary reading in the "common learnings" course.

SHOEMAKER, ROBERT H. *The Best in Baseball.* New York: Thomas Y. Crowell Company, 1949. 250 p. $2.50.

Interesting games and events in the lives of some of baseball's greats: Newhouser, Simmons, Boudreau, Simmons, Feller, Williams, Musial, Cochrane, Hornsby, Dean, Traynor, Hubbell, Di Maggio, Frisch, Gehrig, Ruth, and Cobb.

BEALLE, MORRIS A. *The Georgetown Hoyas.* Washington, D. C., Box 1623: Columbia Publishing Company, 1947. 228 p. $3.50.

This is the interesting story of football at Georgetown University since 1887. Complete records by years and by opponents and history of various games, teams, and individuals are included.

BEALLE, MORRIS A. *The Washington Senators.* Washington, D. C., 639 F Street N.W.: Columbia Publishing Company.

This is the story of the oldest baseball team in the United States. It was organized in 1859. Although shy on winning teams, more than one fourth of Baseball Hall of Fame players were former Washington players. Baseball fans will thoroughly enjoy this interesting story of America's greatest sport—one of the things most characteristically American.

CARMICHAEL, JOHN P. *My Greatest Day in Baseball.* New York: Bantam Books, Inc., 1948. 247 p. $.25.

Many of baseball's greats (47) tell about their greatest day in baseball. Most of the great stars of the past are included. To the baseball sports fan this is a thrilling book, especially to those that saw many of the stars of yesteryear in active play. Wonder how a "red-letter" day or event by some of America's greatest teachers would read like? Seemingly no one has ever tried to write such a book—My Greatest Thrill in Teaching!

MEANY, TOM. *Baseball's Greatest Teams.* New York: Bantam Books, 1950. 275 p. $0.25.

Teams described are: Pittsburgh Pirates 1909, Detroit Tigers 1909, Chicago Cubs 1908, New York Yankees 1927, St. Louis Cardinals 1942, Philadelphia Athletics 1929, Boston Red Sox 1915, Chicago White Sox 1917, Brooklyn Dodgers 1941, Cleveland Indians 1920, Cincinnati Reds 1919, Boston Braves 1914, New York Giants 1921, St. Louis Browns 1922, Washington Senators 1924, and the Philadelphia Phillies 1915.

BERKELEY, EDMUND CALLIS. *Giant Brains or Machines That Think.* New York: John Wiley and Sons, Inc., 1949. 270 p. $4.00.

Man has developed machines that *think*—machines that learn, remember, reason. These

machines can calculate, make decisions, choose between different courses of action, determine most of instructions. Only since 1940 have men constructed mechanical brains, yet the power of such machines are so great that the author believes their future possibilities are so great that a second industrial revolution is in the making.

Giant Brains is intended for the lay reader. It describes several existing large-scale mechanical computers. They can, in a short time, solve complex mathematical problems that would take a mathematician months or even years to solve. Addition, subtraction, multiplication are simple; square root, logarithm problems are solved quickly and accurately.

Punch card machines are used very extensively. Information is coded and punched on a card and then the machine sorts out and tabulates the desired information.

The latter chapter discusses some of the problems that machines of the future may solve for man. A vast amount of miscellaneous data may be sorted and accurately tabulated in a very short time. Educational research workers as well as business and industrial concerns will use these machines very extensively in the future at a tremendous saving of time, effort, and money.

CHESKIN, LOUIS. *Colors: What They Can Do For You.* New York: Liveright Publishing Corporation, 1947. 333 p. $5.00.

We live in a world of color—in a world of color not dreamed of a century ago. On every hand we are affected by color—color that man himself has effected in one way or another. And people are very color-conscious today—even in men's dress—note the postwar ties and the recent pastel colored shirts. Men and women dress in colors today that would have cost a king's ransom and been the envy of all less than a century ago. Actually the colors prized by royalty a century ago would be disdained today—we have so much better ones today.

Colors have an important psychological effect upon us—affecting us for good or ill in the color schemes of rooms and furnishings, making rooms less or more comfortable, our foods less or more tasty, the things we buy, the letters we answer and so on.

Colors can remake your world—can do much toward making your life happy or unhappy. All of this is discussed by the author in this unusually fine book on color. Color is considered from the standpoint of the physicist, the physiologist, and the psychologist. Color is considered as the artist, as the scientist, as the layman, as the business man, the advertiser looks at it. There are 16 illustrations in full color. The material is presented interestingly, comprehensively. It is not a technical treatise but should serve excellently for the elementary science, general science, physics, and physical science teacher. The reviewer considers *Colors: What They Can Do For You* the finest book of its kind for the laymen and for general reference reading, that he has ever happened across. But even artists, science teachers and others interested in more technical aspects of color can gain much interesting and valuable information from reading it. The author is Associate Director of the Color Research Institute of America.

ILIN, M., AND SEGAL, E. *Giant of the Crossroads.* New York: International Publishers, 1948. 224 p. $2.50.

This story of the ancient civilization of Egypt, Greece, and Rome by the authors of "How Man Became a Giant" reads like a newspaper story of today with all its exciting adventure. The heroes of history are not the kinds and generals of the ancient world but the philosophers, scientists, writers and thinkers, those who pushed back the boundaries of knowledge; the sailors who brought closer the uncharted seas; the slaves who built the great cities and famous roads; the craftsmen and farmers who toiled at their trades. Of course the giant is mankind itself who starts as a man who lives in a narrow house and finds the key to let himself out into a world he does not understand. Man thinks himself a giant too soon and has to search for the road and learn of wise men and in the grim school of experience how to grow and how to live. The writers make us look forward to another story of our hero in another book where we may watch our hero still at work trying to make over a world.

GRETA OPPE

ECKSTEIN, GUSTAV. *Everyday Miracles.* New York: Harper and Brothers, 1948. 235 p. $2.75.

Through sympathetic observation of animals, a brilliant scientist here illuminates the miracles of all life by choosing some common theme in man's many-sided life and presenting an incident in the life of a non-human creature to illustrate this common theme. A dog points to the miracle of hearing; a cat, to his sense of time; a macaw, the idea of speech. Throughout the book animals become instruments of miracles experienced in everyday life and the reader is enriched by these lively pictures of vivid experiences that really happened.

GRETA OPPE

MALINOWSKI, BRONISLAW. *Magic, Science and Religion.* Boston, Mass.: Beacon Press, 1948. 327 p. $3.50.

These essays are written by one of the few most original students of social relations of this generation. The author was born in Poland in 1884 and died in 1942. An illness while a student forced him to give up chemical research and a copy of James Frazier's book, "Golden Bough," turned his attention to anthropology. Most of his research was done in the South Pacific, especially among the Trobriand Islands. From these studies we learn both the life of primitive peoples and the life of common humanity. This posthumous collection of five essays is a book every-

one interested in the history of the science of man should read.

GRETA OPPE

PETERSEN, WILLIAM. *Man—Weather and Sun.* Springfield, Illinois: Chas. C. Thomas, 1947. 464 p. $10.00.

The exposition offered the reader under the title of this unusual book is a detailed study of the inorganic environment on the human organism. The author explains in the preface that the idea was developed in 1920–1930 at a time when weather as a cause or effect in medical practice had been outmoded. His observations continued during the next ten years but were seriously curtailed because of the lack of cooperation by his university but in 1940 a set of triplets in his classroom presented the opportunity of observing reactions in like individuals. The author does not limit his observations to the triplets but extends his observations to the population at large, how individuals conform to a pattern and how there is a cyclical behavior of the mass of mankind during epidemics, restlessness, and revolutions. This study is probably the first in which direct evidence is presented on the significance of weather on the human race. This is not a book written in popular style but a mass of data to be interpreted by those interested in a study of the human organism and its integration with an inorganic environment.

GRETA OPPE

HUXLEY, JULIAN. *Man in the Modern World.* New York: The New American Library, 1948. 194 p. $0.35.

An eminent scientist looks at life today in *Man in the Modern World.* The essays in this little book are selections from "Man Stands Alone" and "On Living in a Revolution" both published by Harper and Brothers. If man is looking for values for a modern world, then the reader should read *Life Can Be Worth Living.* For those who say there will always be war, let them read "War as a Biological Phenomenon." In 1946 Dr. Huxley was made Executive Director of the Preparatory Commission of Unesco and in 1946 was elected Director General of Unesco. He therefore brings to the reader a philosophy that human nature contains no specific war instinct. There is an aggressive tendency but it can be moulded into varied forms of competition so that men may find a "moral equivalent of war" and set up the right kind of international machinery to abolish wars.

GRETA OPPE

SULLIVAN, J. W. N. *The Limitations of Science.* New York: The New American Library, 1949. 192 p. $0.35.

The Limitations of Science is a creative scientist's approach to the unknown. He visualizes for the reader the limited aspects of science but the limitless potentialities of human consciousness and science. Sullivan is a brilliant science interpreter and writes of the expanding universe, the mystery of matter, the "web" of reason, origins, values of science, and the nature of mind. He presupposes that biology will give birth to radically new conceptions in the future. "Physics," he says, "is approaching finality in the sense that it is approaching a stage of complete unification." Maxwell's theory unified light, electromagnetism, and radiant heat. The theory of relativity has effected a further great unification, so that gravitation and the laws of mechanics are affected.

GRETA OPPE

BERNARD, CICERO HENRY. *Laboratory Experiments in College Physics.* Boston: Ginn and Company, 1949. 291 p. $2.75.

This is a laboratory manual for the first course in college physics. The experiments are designed for the usual 3-hour laboratory period. An unusual beginning is the author's directions for the first laboratory period devoted to a study of possible errors, hoping to help the student to increase his efficiency. There are 48 experiments and the manual adapts itself for use with any college textbook in physics.

GRETA OPPE

EDDY, SAMUEL. *Atlas of Drawings for Chordate Anatomy.* New York: John Wiley and Sons, Inc., 1949. 189 p. $3.00.

This book is an atlas of unlabeled drawings of the structure of animals commonly studied in comparative anatomy. It is intended to serve as a workbook for a longer course than that for which the older atlas, *Atlas of Outline Drawings for Comparative Anatomy* was intended. This book covers the structures of the common types representing the major classes of Chordates. The author feels that the proper use of these superior drawings will not only save time but be of greater value than the mediocre drawings a student often makes. This does not eliminate dissection. The student should carefully dissect his specimen and label the structures in the atlas, thus giving the student a permanent source for review after the specimen has been discarded.

GRETA OPPE

GATES, R. RUGGLES. *Pedigrees of Negro Families.* Philadelphia: The Blakiston Company, 1949. 267 p. $5.50.

This study brings together over two hundred pedigrees of Negro families, mainly from this country, but also from Canada and various parts of the West Indies, and from British Guiana. The studies demonstrate clearly that inheritance in the Negro race is nowise different from that in other races. The traits, the inheritance of which is studied, include not only many physical and physiological abnormalities, but also such features as musical and artistic ability. The last two chapters are devoted to the inheritance of racial characteristics and a new hypothesis of the inheritance of skin color is proposed. Altogether this seems to be an excellent research study in human inheritance. There are two hundred forty-five illustrations, mostly inheritance symbol charts.

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